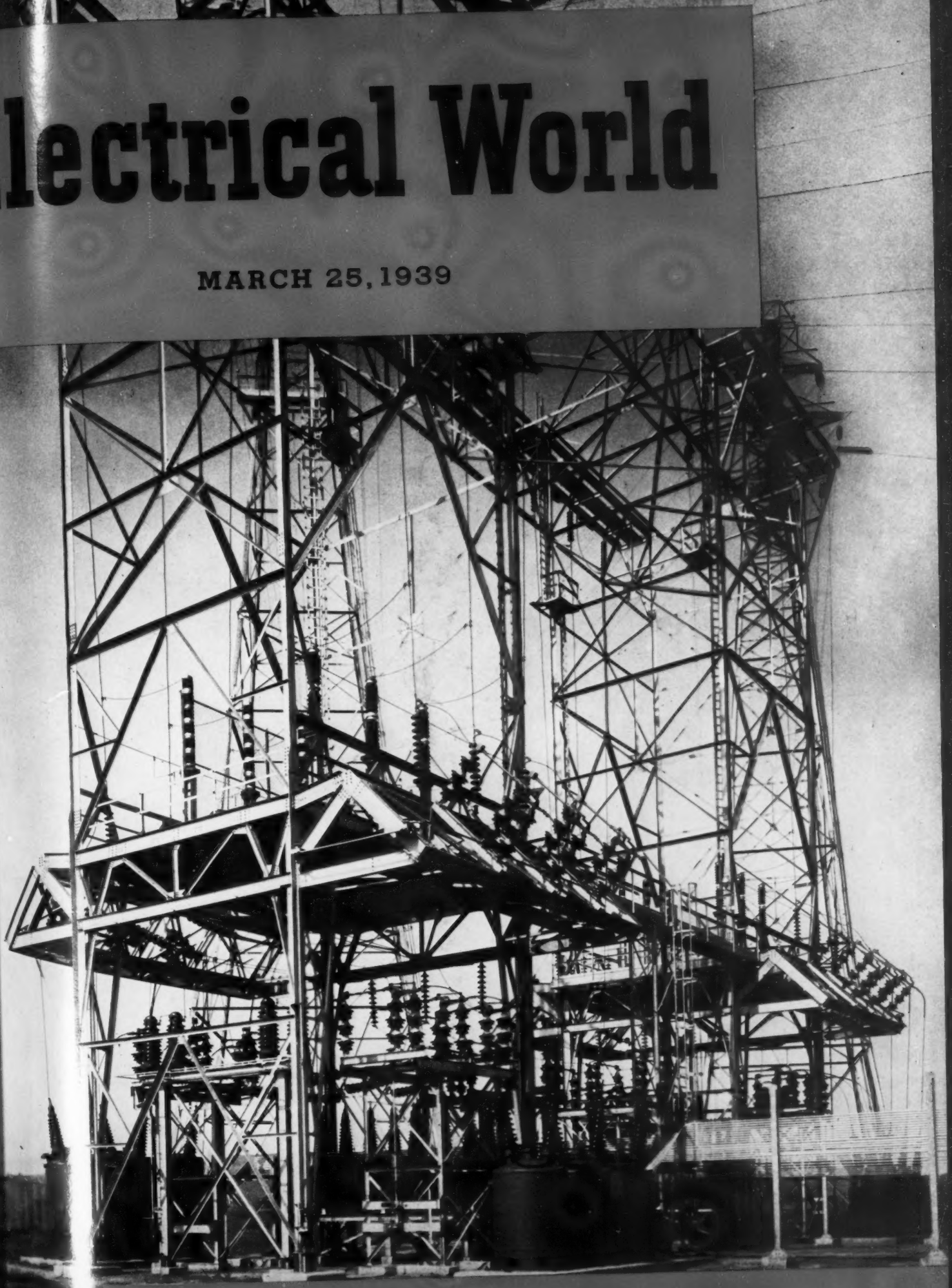
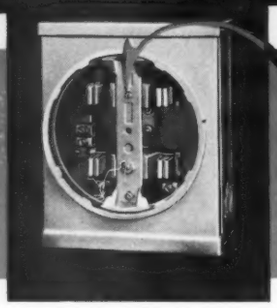
Electrical World

MARCH 25, 1939



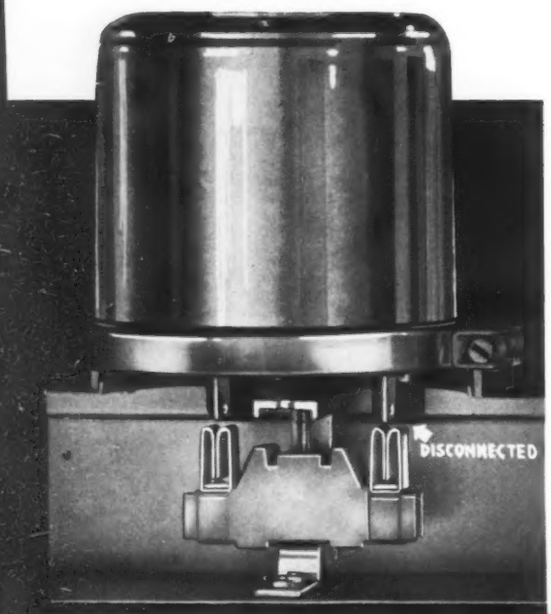
Direct Tie at 66 Kv. Between Steel Mill and Utility Systems



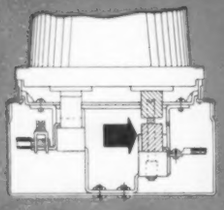
New!

DEVELOPED SOLELY FOR SOCKET METER

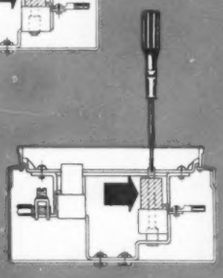
FASTER TO DISCONNECT • ONE SCREW DOES THE WHOLE TRIC



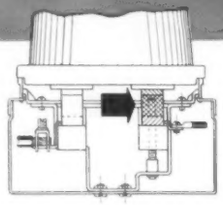
Just a **single** screw (the red arrow in the picture above points to it) is **all** that need be turned for **complete** DISconnection or connection. The action is smooth, quick, positive—and tamperproof! No wiring within the Murray trough is disturbed. The photographs and the diagrams show clearly the clean-cut operation of the Murray Disconnect. Send the coupon below for the new Murray Disconnect Meter Trough book—just off the press. It covers this and other Murray Meter Troughs in detail, with plenty of explanatory pictures. Yours for the asking. Metropolitan Device Corporation, Brooklyn, New York.



The porcelain - mounted jaws rise or fall as a unit when the Murray Disconnect Screw is turned. Note complete separation of blades and jaws.



Meter removed to reveal Disconnect Screw. Any screwdriver will make the adjustment.



Murray Disconnect Screw Raises jaws into contact.

METROPOLITAN DEVICE CORPORATION

1250 Atlantic Ave., Brooklyn, N. Y.

Please send 20-page illustrated booklet describing Murray Disconnect and other types of Socket Meter Troughs.

NAME_____

TITLE_____

UTILITY_____

ADDRESS_____

Appliance Prices

Pressure is being brought to bear against appliance prices from several different directions. Package sales at substantial discounts from lists, REA-Iowa experiments with low prices, utility demand for major appliances to sell at retail for up to a third off present price—these are the directions of an attack on appliance prices that apparently is winning some ground.

Are prices too high? Has any attempt been made to find out? The manufacturer is not getting rich on present prices and if market development and sales promotion expenses are taken into account it is doubtful if he makes any worth-while profit. If, then, the price of the product is too high from the standpoint of cost, is it too high from the standpoint of what the consumer will or can pay? If so, how much will he pay and how much will he buy at that price? Who knows?

Merely to say that prices are too high is to invite ill will. No one felt more hurt than the utilities when their rates were attacked as being too high. They know that for the most part the attack was unjustified and unfair. They knew that low rates of themselves never raised consumption—that it took selling to build load. They also knew, and if they didn't they soon found out, that low rates couldn't be compensated for by a proportionate increase in sales volume. Knowing all of these things, one would think that the element of fair play, if nothing else, would deter them from attacking another's rates.

There is no question but what major appliances can be produced for less with greater volume. There is no question but what utilities earn a lower price for large carload buying orders. How much can the price be lowered this way? Enough to bring a $150 appliance below $100? Probably not—at least with the present design and material quality.

But suppose the utilities could secure the prices that are asked for, what of the dealer? Obviously the dealer could not secure the same price because his orders would be much smaller and it would cost more to sell him. Would the utility expect to use its advantage to the detriment of the dealer? It would be a mistake to do so. Dealer co-operation would dry up quickly, and with it a tremendous load-building volume. Good will would be sacrificed—a thing that is so precious today to any utility—and the flood of anti-merchandising bills would break out anew.

It is unfortunate that many manufacturers are so hungry for business that they are willing to snap at almost any bait. It is going to take courage to repulse such offers. But now is the time to take a stand. So far the damage is not great, but the demand for special prices and bargain-counter offers is growing. Unless it is checked promptly, it will soon become unmanageable.

Such a condition can never be kept to a single locality. What is done for one company must be done for another. If it is right to give REA special prices in Iowa, what is to prevent any power company from asking for like terms?

There will always be a certain group of manufacturers that will not be able to resist big buyer demands. When they find out their mistake they may try shoddy merchandise as a way out, or they may go out of business. In either event, the buyer sooner or later loses.

It is possible that through co-operative conference it can be determined what is a price that the market will pay and in what volume, from which decision might come a design that will meet that condition, allowing sufficient margin for sales and promotion. In any event, extreme care should be taken not to discourage the dealer. The conditions that are bringing about this price consciousness are only temporary. When business picks up again, let's be sure that the dealer can and will carry his full share of the load of appliance sales. This is no time to rock the boat.

WARNS OF PIPE AHEAD

CHARLES I. MAUST, *Public Service Electric & Gas Company, Newark, N. J.*

No longer an experiment—The anticipator on this machine has been working summer and winter for 2½ years. Note the shale being excavated from manhole, which is paralleled by "mains"

MECHANIZED underground construction in city and suburban streets for electrical duct line systems was introduced under conditions when it was deemed necessary to dig carefully with picks, shovels, pneumatic hammers and small-charge blasting. Mechanization, with the assistance of the "Automatic Pipe Anticipator," was adopted by this company in order to save time, economize, create good will, reduce weather interruptions and decrease accidents. The anticipator is an electrical device which gives the operator of excavating machines warning of the proximity of pipes and cables and permits excavation close to such obstacles without damaging them.

Due to the character of the surface and subterranean conditions in streets, there has been a definite limitation in the scope of work that excavating machines could economically do, even with the advantages of good mechanisms, controls and clever, alert operators. Mechanical excavation for highways, buildings, mines, subways, etc., is common world-wide practice today because it is practicable, speedy and economically sound. Excavating machines worth hundreds of millions of dollars have paid for themselves many times over in the above fields of excavation. The natural question was, a few years ago, why not profit by such experiences and adapt the machines and the procedure to meet the special street conditions encountered in public utility construction. This has been done by the under-

OF EXCAVATING MACHINE

"Automatic Pipe Anticipator" gives audible signal to machine operator telling him he is coming close to a pipe or a cable. Device may be set for various ground conditions and excavation carried up to within a few inches of obstruction. The "Anticipator" may be used with all types of digging machines

ground and transmission construction department of the Public Service Electric & Gas Company after the development of special devices and tools. This department accomplished the results recited in this article with the aid of the anticipator.

Desired Features

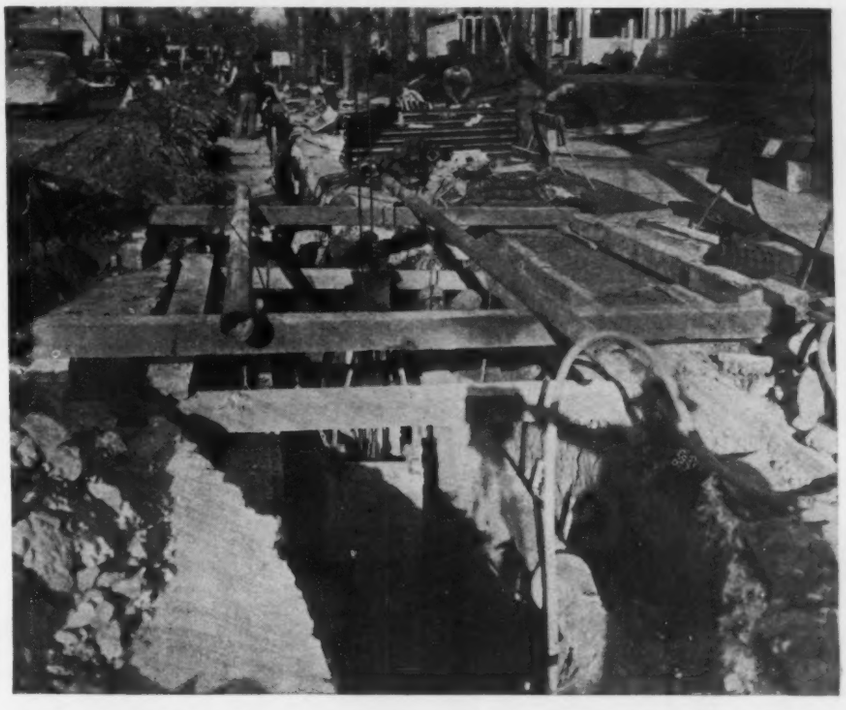
To apply mechanization to underground street work in the busiest arteries, in a maze of underground services, in sand, clay, shale, boulders and blasting rock, the following features were found to be highly desirable:

1. Each excavating machine operator should have a positive automatic method of determining the exact location of every existing metallic service pipe and cable. This is accomplished with the signal device here described.
2. The machines should minimize damage to service members and should be rapid, flexible and have liberal power and smooth control for positive, steady motion.
3. This device should permit the machine to work rapidly, efficiently, and to dig out the maximum percentage of the total-to-be-excavated earth, even though the street is "infested" with pipe lines, manholes, cables, etc.

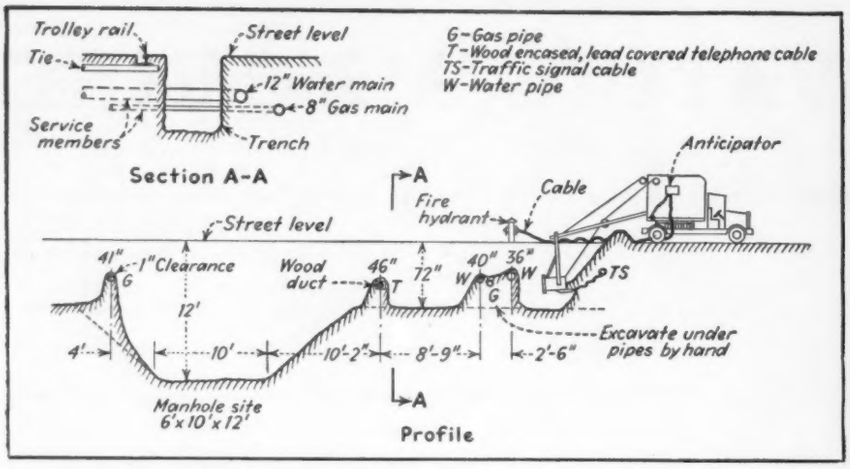
"Pipe Anticipator"

The pipe anticipator was especially developed to permit mechanical excavation under adverse conditions. It is an automatic radio signal device used as an attachment for excavating machines to forewarn the machine operator as his digging tool approaches underground service members such as metallic pipes and cables. The device functions on circuit-impedance principles and has been used for visible signals, audible signals and combinations thereof. Most practicable is the audible signal, thereby assisting the operator without diverting his eyes from his job or interfering with the machine control. The signal device is mounted close to the machine operator's head and gives an audible signal by means of a "speaker." The "speaker" is generally satisfactory for an operator of normal hearing, when used on a machine which is working smoothly; however, an ear phone can be "plugged in" to the set. A stone-deaf operator can use a standard bone vibrator in back of one ear.

The anticipator gives a constant supervisory signal to indicate it is in workable condition. The signal distinguishes whether the "tool," such as the bucket teeth or auger, is either touching, is one or more inches, if desired, or a few feet from an unknown pipe, and it also distinguishes whether pipes are a few inches or a few feet apart. Operator generally adjusts his "soil" dial for obtaining a positive distinguishing signal when the bucket teeth are 6 to 12 in. from a pipe and thereafter with careful digging until the teeth come very close to the pipe. The signal automatically increases in intensity of sound as the "tool" approaches the pipe and decreases as the "tool" moves away from the pipe. The maximum signal is barely discernible by pedestrians, as loud signals are neither desired nor practical. Another unique feature of the anticipator is that it is absolutely immune to all electrical interfer-



Between a paralleled main and a group of telephone cables—There are numerous cross pipes in this hole being dug through shale and clay. The anticipator soil control is adjusted to give the proper distinguishing signal for the cross pipes



Excavation with an anticipator-equipped back-hoe

Using the anticipator
The operator is wearing earphones connected to the device, which may be seen above his right shoulder through the cab front window

ences, such as trucks, buses, trolley return cables, power cables, etc. The set is ruggedly constructed for severe service, easily installed and maintained.

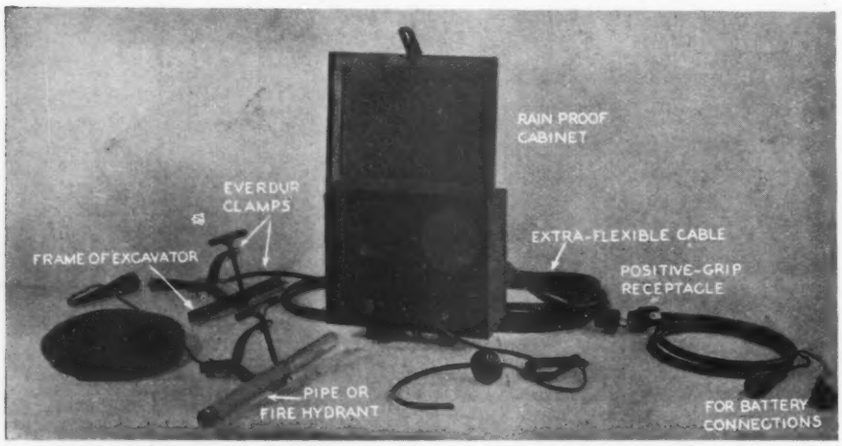
Original sets had separate power supply boxes, whereas the later ones are self-contained and are approximately 11x8x5 in. deep, thereby permitting installation within a foot of the operator's ear and not interfere with his other normal duties. Control circuit includes the excavator bucket, the service pipe and the earth between the bucket teeth and a service pipe. As the bucket moves into the earth toward a pipe the impedance of the separating earth decreases, thereby increasing the volume of the signal in proportion to the inverse square of the impedance. The set includes an oscillator (usually providing an output frequency high in the audible range), special control equipment, amplifier, speaker and ear phone.

Anticipators have "test," "soil" and "volume" control dials. Operator uses the "test" dial to simulate exactly the action of the digging tool any time he so desires. He adjusts the "soil" dial when the earth conditions change radically, such as during or after a storm or when the device is moved to a different section where the character of the soil may be different.

Extremely rapid digging requires a "distant" setting of the "soil" dial, whereas relatively slow digging permits a "close" setting of the dial. The "volume" control is used to suit the operator's degree of hearing.

The machine tool can dig, bore, push or pull rapidly while the operator is getting only a supervisory signal and excavate slowly and cautiously as he receives a warning of approaching a service member. Due to the anticipator, the machine can dig nearly all of the earth off the pipes and leave a small portion under the pipes for hand excavation.

Exact positions, spacings, directions, depths, slopes, bends, connections and crossings of service members are not accurately known even when plotted by customary survey methods. Spacings varied from a few inches to a hundred feet apart, but averaged 18 ft. separation for the 32,000 ft. of major trenches and manholes excavated where the anticipators were used, during the development stages of the mechanization. In most cases only general locations of pipes and cables have been recorded and the records of the final construction are usually not up to date. Years of experience in this field have proved that the records are too inaccurate to permit mechanized construction of underground services without the use of the anticipators, except in isolated instances, such as open country and some rural sections.



Complete with all leads and accessories

"Anticipator" Applications

Anticipators have been built for and used on the following types of machines: Crawler and wheel-mounted cranes, 180, 270 and 360-deg. revolving cranes, machines with lever and air control systems, clamshell, back-hoe and skimmer buckets, ladder type ditching machines. They work equally well on the crawler and wheel-mounted cranes. However, in the case of the crawler, if the caterpillars contact a trolley rail a false signal will be received, therefore 1-in. boards are generally laid on the rail, if it is necessary for the "cats" to travel on the rail. If the "cats" clear the rail by as little as a

[*Continued on page 48*]

Correlating Sales With Distribution Evolution

Reconcile functional and geographical characteristics of loads with distribution system potentialities in order to keep future distribution costs within bounds

W. R. BULLARD, *Consulting Engineering Staff, Ebasco Services, Inc., New York*

DISTRIBUTION SYSTEM OUTLAY is one of the most costly factors in utility construction of recent years. Frequently it is the most costly. In fact, the executive is constantly impressed by the realization that it often exceeds all other items combined. Thus during 1938 the expenditures of the U. S. clients of Ebasco Services, Inc., for distribution (including distribution substations) were approximately 58 per cent of total construction; in 1937 the percentage was 60.5.

Progress has been made toward making distribution less costly, and further progress is definitely available through systematic co-ordination of sales and distribution engineering effort. Such co-ordination involves:

(a) Full interchange of information between sales and engineering staffs.

(b) Full co-operation between engineering and sales staffs in planning the relation between distribution system characteristics and functional and geographical characteristics of loads.

Barring unforeseen exceptional changes in practice which will result in methods of less costly construction, it is obvious that present and future investment in distribution must be worked to maximum capacity. Certainly, if the large fraction of investment devoted to distribution is to be reduced, it will require more and more co-operation between the sales department, which creates the loads, and the distribution department, which strives to serve them economically. The task of concentrating on loads which will meet the technical and economic limitations of distribution is thus one which calls for close correlation between the sales staffs and distribution engineers. For the distribution engineer it affords an excellent challenge not only to bring down the cost of distribution construction but also to co-operate with sales departments in shaping a load-building policy which will be selective toward loads which make present systems most productive of net revenue.

Planning Technique Improved

The distribution engineer attempts to plan his system so that present construction will accord reasonably with needs of the future, but frequently he finds that load growth expected in a given area fails to materialize there, but actually occurs in a totally different area, or that instead of predominant growth of a particular kind of load, as expected, an entirely different type enters and dominates the picture.

An example of the latter type of occurrence is the startling change that has taken place in many areas in the power factors of residential loads during the past very few years. In many locations power factors of 80 per cent are now common and of 70 per cent and even 60 per cent are being encountered. A few years ago, with lighting loads and heating appliances predominating, a residential peak power factor lower than 90 per cent represented an exceptional case. This change has required a revision in the technique of distribution design.

Considerable progress has been made within recent years in the development of general measures for distribution simplification and reduction of costs. These developments include such items as:

Improved loading of distribution transformers.

Use of common (combined primary and secondary circuit) neutral conductor.

Interconnection of lightning arresters with the circuit neutral.

Use of bare instead of weatherproof-covered conductors.

Use of capacitors to release system capacity where poor power factor is prevalent.

Use of auto-transformers to reduce voltage flicker.

These are a few of the items, and there are many others.

In addition, the engineering technique of planning the expansion of distribution systems has been greatly improved. Improved methods of laying out circuits, such as of locating transformers, determining sizes of circuit copper, have been developed. Thus distribution engineers now have tools of greatly improved effectiveness to assist in carrying out their work. Notwithstanding the gains mentioned, the job is not finished and progress in reducing costs must continue.

Coping With Changing Loads

An immediate and promising field of attack for the distribution engineer is in coping with the changing, and largely unpredictable, functional character and geographical configuration of the loads which the distribution system will be called upon to serve. It is conceivable—indeed theoretically quite possible—that a system could be so designed and constructed that, without adding a wire or a piece of equipment, it would be capable of serving, at any location in a given territory, the growth of load for a considerable period, including loads of any type or size ordinarily encountered. But any distribution engineer submitting such a design seriously for executive consideration would speedily be deprived

* Founded on paper delivered at Annual Sales Conference of Ebasco Services, Inc., client company representatives.

of his job because the cost would be absolutely staggering. It follows logically that if some way can be found to plan the distribution system to follow (more efficiently than at present) the changing characteristics of the load, savings in cost will result.

This is a place where the distribution engineer needs the help of the salesman, and it is only through fully co-ordinated effort of the two that a thorough job can be done.

After all, both the salesman and the distribution engineer are working for the same objective, that of placing needed service at low cost to the public and with an adequate net return to the investors. Net return, of course, involves not only the quantity of service sold and the corresponding remuneration, but also the cost of the service. To accomplish the stated objective, the work of the distribution engineer and of the salesman are mutually interdependent, and to serve the best interests of their employers and the public, close co-ordination must be secured. What, then, are the elements of this co-ordination?

Geographical Characteristics

Speaking first of geographical considerations, the elements are:

(a) Interchange of information as to geographical availability of service, as to geographical distribution of prospective loads and as to prospective sales activities and the probable effects thereof on load growth in various districts.

(b) Co-operation on the part of the distribution engineer by advance planning gauged by probable effects of sales activities, and on the part of the sales staff by planning of sales programs for preferential activities in locations where existing distribution facilities are adequate to serve additional loads, as against locations where existing facilities are taxed to their capacity. In the case of ranges and similar low load-factor devices, geographical concentration gains the advantage of diversity and thereby reduces the required amount of distribution capacity. Thinly scattered ranges are very costly to serve. Thus sales activities that result in grouping such loads geographically bring lower costs to serve.

As one example, Birmingham Electric Company is doing a very commendable job in this direction, range and water-heater sales activities being guided in detail by map records of the system.

Functional Characteristics

Functional characteristics of load also have a profound influence on distribution design and costs. By careful attention to these characteristics, in conjunction with selling the service, distribution costs attributable to their influence frequently can be avoided or greatly reduced. Some examples are:

1. *Motor-Starting Currents*—A motor with high-starting current may cause voltage flicker and serious annoyance to customers in its neighborhood, which can be corrected by measures in the distribution system only at considerable expense. Air-conditioning motors are notable offenders in this particular. A motor with lower starting current, or with starting current controlled so that it is applied gradually, will avoid the extra distribution expense with corresponding benefit to the company and ultimately to the customer.

2. *Power Factor*—The startling change in residential power factors mentioned earlier has been due to the increasing use of motorized devices such as refrigerators, fans, washing machines, electrically operated oil burners, and miscellaneous applications.

A corresponding change in commercial districts has been brought about by the rapid growth of air conditioning. These power factor effects can be minimized by impressing upon the customers, the dealers and the suppliers the advantages of equipment having reasonably high power-factor characteristics.

3. *Load Factor*—Loads of low load factor are distinctly costly to serve unless they can be combined with other types of loads in such manner as to produce relatively high load factors for the combination.

This means, of course, the placing together of loads whose major demands occur at different hours or days, or, in the case of existing distribution load curves of poor load factor, it means the "filling in of the valleys in the load curve" by introducing off-peak loads. Examples of load-factor loads are ranges and air conditioning, the latter especially. One avenue open to the securing of improved load factors is the sale of utilization equipment having storage characteristics, such as storage type water heaters and air-conditioning systems with storage features.

4. *Concentration* — Individual appliances involving loads of large magnitude are more costly to serve from the general distribution system at a given location than the same total loads in smaller units.

Thus in centralized air-conditioning systems it is desirable from the distribution standpoint that the equipment be divided into two or more smaller units rather than being comprised in a single unit; also, from the same standpoint, the use of a number of unit-type room conditioners is preferable to the centralized system.

5. *Pulsating Loads*—Reciprocating compressors for air conditioning or similar loads having pulsating characteristics often cause voltage disturbances very annoying to customers and costly to correct.

This is particularly critical if the frequency of pulsation is within a range between three and sixteen cycles per second. Some remedies are: Use of rotary compressors, use of flywheels to reduce pulsations, employment of cyclic frequencies as far removed as possible from eight cycles per second (the approximate point of maximum perception of light flicker caused by voltage fluctuations).

Elements of Co-ordination

The elements of co-ordination of sales and distribution engineering effort necessary to fit the system design closely to the functional characteristics of the load are similar to those mentioned in connection with geographical characteristics. They are:

(a) Interchange of information as to effects of load characteristics on system design and costs, and as to types of loads, both generally and individually, that are contemplated in sales programs. To be fully effective, this should include contact between salesmen and engineer at an early stage, and before promises or commitments, in connection with any prospective load involving new problems.

(b) Co-operative engineering and sales activities guided by the information comprised in (a). On the sales side this means, first, concentrating selectively on the sale of loads of the types that are most desirable, all things considered, and, second, keeping customers fully informed of and maintaining customer respect for company regulations covering motor characteristics and allied requirements.

For co-ordinated planning of distribution and sales the aim, therefore, is to stimulate interest in positive efforts toward working out more comprehensive programs of co-ordination.

Behavior of High-Voltage Insulators on Radio Test

In testing insulators by the E.E.I.-NEMA-R.M.A. recommended circuit for the measurement of radio interference several interesting phenomena are observed. All these should be recognized to obtain best results

CHARLES J. MILLER, Jr., *Electrical Engineer Ohio Brass Company, Mansfield, Ohio*

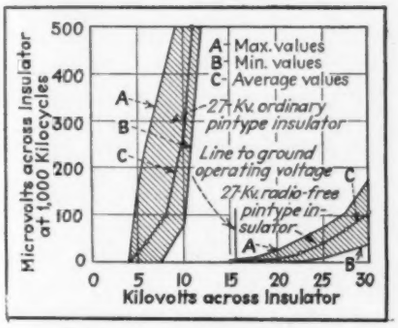


Fig. 1—Ordinary insulator has higher noise level

FUNDAMENTALLY, radio interference originating from insulators is caused by an overstressed condition of a dielectric medium in an intense electrostatic field. The dielectric strength of air is about 30,000 volts per cm., and when the electric gradient exceeds this value the air is overstressed. Radio interference is an electrical manifestation of the overstressed condition of the air and corona is a visual manifestation of the same phenomenon. Both corona and radio interference are usually observed when the air adjacent to an insulator is overstressed, but, as will be shown later, the intensity of corona relative to radio interference is not always the same. Since radio interference is caused by overstressed air, the modern trend is to construct the insulator in such a manner that the surrounding air is nowhere subjected to an electric gradient sufficient to cause its breakdown.

The normal procedure for determining the radio interference characteristics of an insulator is to apply a voltage to the insulator and measure the amount of radio interference for that voltage. (See "Establishes Method of Measuring Radio Interference," ELECTRICAL WORLD, March 11, page 48.) A curve may be obtained by measuring the noise at various voltages and plotting the results on co-ordinate paper. It has been found after several similar insulators have been tested that the resulting curves usually do not coincide, but cover a band. A convenient way to present the data is to give a band which includes the maximum and minimum test values together with the average curve within the band. Two such bands are shown in Fig. 1.

The plain pin-type unit has been a source of radio interference in the past. The air spaces between the tie wire and the head of the insulator and between the metal pin and the porcelain threads at the pinhole are usually overstressed at operating voltage. In most cases a wood crossarm is in series with the insulator, in which case the voltage across the insulator itself is not the full operating voltage of the line and accordingly the line may be less noisy. Fig. 1 shows the band for 27-kv. plain pin type insulators. Noise starts below 5 kv. on the insulator and may be several thousand microvolts at the operating voltage of 15.6 kv. The equivalent radio-free pin type has a very low noise level at operating voltage and doesn't reach the 100-microvolt level until the voltage is about 27 kv. Although 100 microvolts has not been officially adopted as a satisfactory noise level, observations indicate that if the noise does not exceed this value interference is negligible.

Ascending, descending voltage

In running radio interference curves the voltage may be varied by either increasing or decreasing the voltage step by step. Fig. 2 shows that in most cases for suspension, switch and bus and pin type insulators the radio noise at a given potential appears to be slightly higher for ascending than for descending volt-

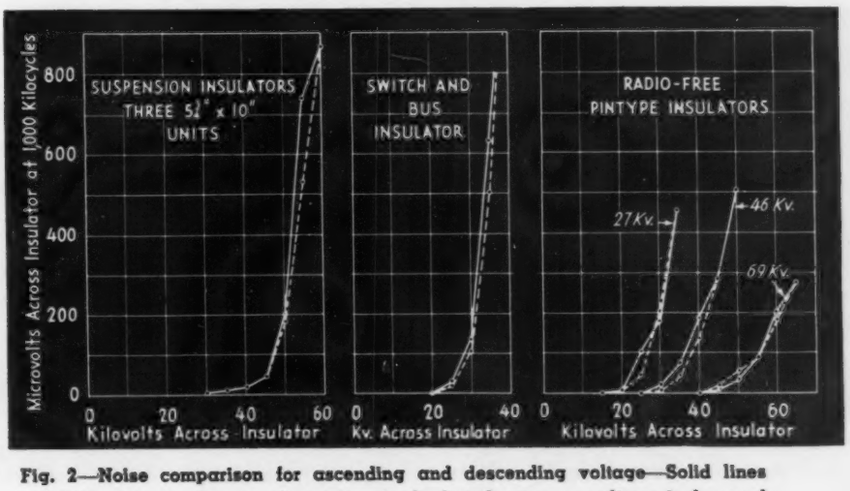


Fig. 2—Noise comparison for ascending and descending voltage—Solid lines indicate noise levels as voltage is raised; dotted ones as voltage is lowered

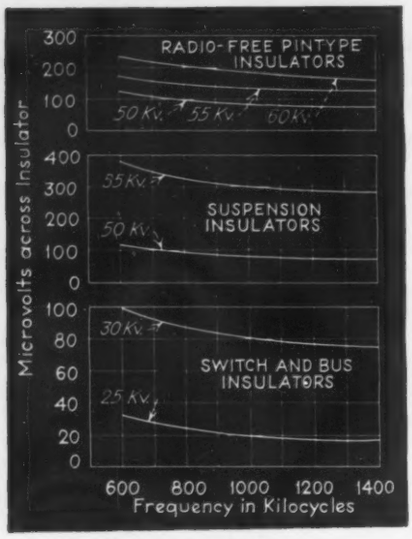


Fig. 3—Interference varies over the broadcast band

There seems to be more radio interference from an insulator at the bottom of the broadcast band than at the top. Since the curves are fairly flat, measurements at a single frequency are indicative of the interference characteristics over the entire broadcast band. A test frequency of 1,000 kilocycles is convenient as it is near the center of the broadcast band.

age. However, from a practical standpoint the difference is negligible.

Tests show that the radio interference is a little greater at the lower frequencies for a given voltage across the insulator. Fig. 3 shows the variation of interference over the broadcast band on several types of insulators. The curves are fairly flat and, accordingly, measurements made at a single frequency near the middle of the broadcast band are indicative of the characteristics over the entire band.

It has been found that when potential is first applied to an insulator the noise level may be somewhat higher than a level obtained after a few minutes under voltage. Noise ratio curves are shown in Fig. 4, the noise ratio being the ratio of the noise at any moment after potential is applied to the final steady state noise level. The curves for the various kinds of insulators are similar and show that a steady noise level is nearly always obtained after fifteen minutes and in certain cases within two or three minutes. In using the recommended circuit, certain precautions should be made to insure that the insulator has reached a steady state.

To determine how humidity affects radio interference a group of five different insulators were run under various conditions. The noise levels at 30 kv. are shown in Fig. 5 for the various insulators. These limited tests indicate that the lower the vapor pressure the greater will be the noise level. However, the variation due to humidity is so small compared to other factors that for practical purposes it may be neglected.

Residual Charge on Insulators

When a porcelain insulator has been subjected to a high over-voltage for a short time or has been flashed over a residual positive charge remains on certain places which may alter the interference characteristics appreciably. The effect of the residual charge upon various insulators is shown in Fig. 6. The solid curves were taken with ascending voltage without a "warm-up" period. The dotted curves were taken after the insulator was held for five minutes just under flashover and then flashed over once.

Because of the effect of residual charge, radio tests on insulators should not be made immediately after flashover tests unless the charge is removed by wiping with a damp rag or stabilized by some other method.

The ordinary transmission line has thousands of similar insulators all operating in parallel. Each insulator has its own noise level and the net noise level of the line should not be much higher than that of the noisiest units. Each insulator is supplying noise to the line, but all the noise voltages are in parallel and therefore the multiplicity of insulators will not in general cause noise on the line substantially higher than an individual insulator. Fig. 7 shows the individual curves for five different insulators and the resultant curve obtained with all five units tested in parallel. As indicated in Fig. 7 the resultant curve approaches very closely the highest individual noise curve.

Radio interference has long been associated with corona and it was thought that corona and radio interference occurred simultaneously. With the advent of the new method for measuring radio noise, it has been found that radio interference and corona near the threshold of disturbance are not as closely allied as was formerly believed. The parent of both radio interference and corona is the ionization of the air in the regions of high electric stress. Radio interference is an electrical manifestation of ionized air and is probably due to sudden changes in

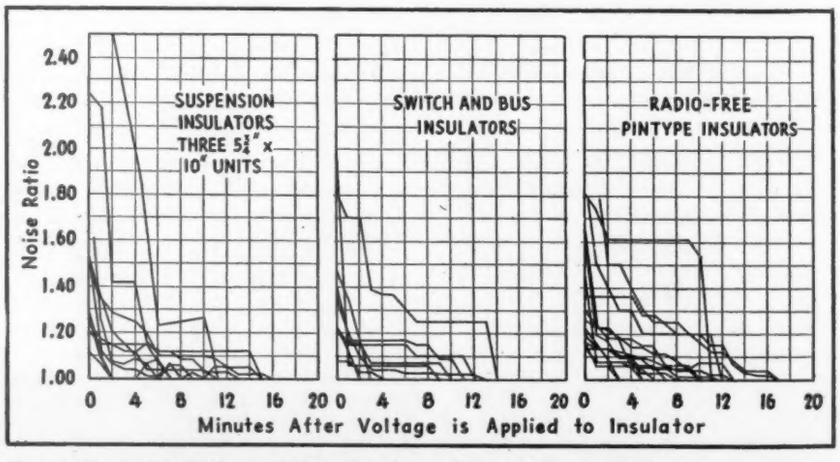

SUSPENSION INSULATORS THREE 5¾" x 10" UNITS
SWITCH AND BUS INSULATORS
RADIO-FREE PINTYPE INSULATORS
Noise Ratio
Minutes After Voltage is Applied to Insulator

Fig. 4—Somewhat higher interference when voltage is first applied

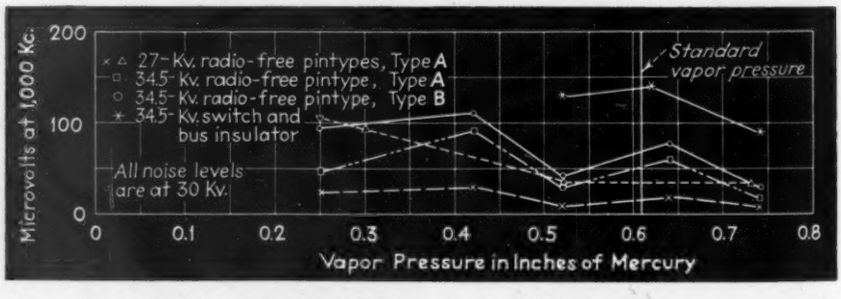

27-Kv. radio-free pintypes, Type A
34.5-Kv. radio-free pintype, Type A
34.5-Kv. radio-free pintype, Type B
34.5-Kv. switch and bus insulator
Standard vapor pressure
All noise levels are at 30 Kv.
Microvolts at 1,000 Kc.
Vapor Pressure in Inches of Mercury

Fig. 5—Impractical to consider humidity in noise level determinations

These curves show numerous tests, all of which indicate that interference reaches a steady state in something under fifteen minutes

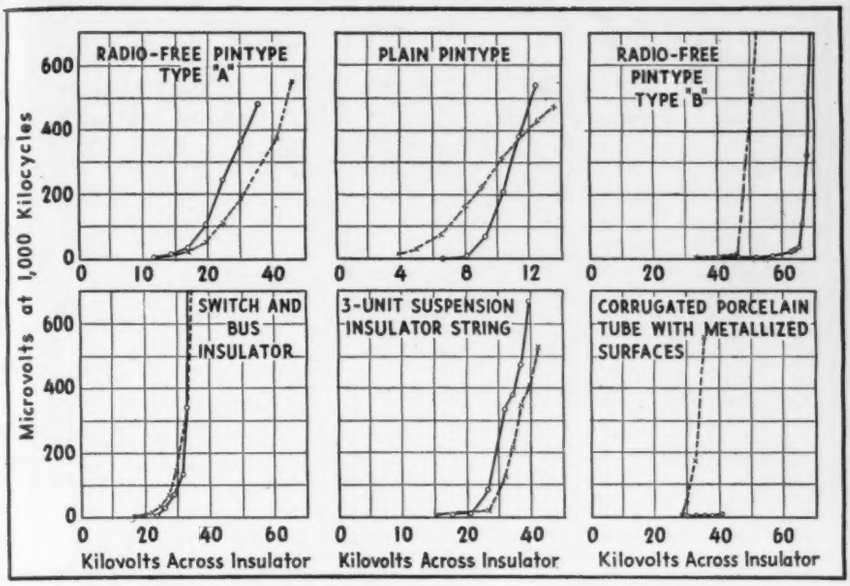


Fig. 6—Effect of residual charge on noise level

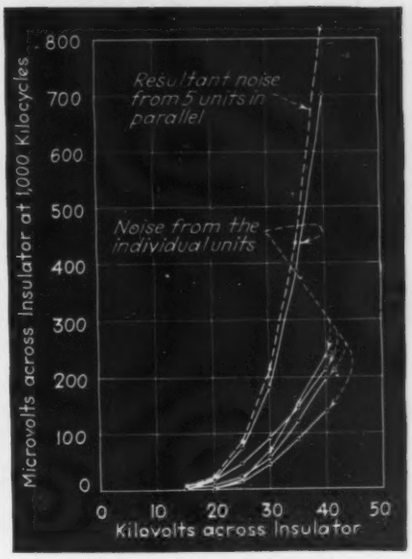

Resultant noise from 5 units in parallel
Noise from the individual units
Microvolts across Insulator at 1,000 Kilocycles
Kilovolts across Insulator

Fig. 7—Insulator noise levels are not directly additive

the electric field as a result of ionization. Corona is a visual manifestation of the ionized air and is produced by the recombination of positive ions and electrons to form neutral air molecules. While both phenomena are usually present when air is overstressed, the intensity of the visual corona is not always an indication of the amount of radio interference.

Fig. 8 shows the result of some comparative tests between radio interference and corona. The tests were carried out on three-unit strings of suspension insulators. The region of greatest overstress is at the base of the cap of the ground unit and the next region of overstress is at the pin of the line unit. In the first test cap corona just disappeared at 23 kv. as the voltage was lowered. The noise level at this point was about 5 microvolts. In the second test the cap corona point was about 50 kv. and the noise level was about 50 microvolts. Thus, the radio interference varied over a range of about ten times for presumably the same amount of visual corona.

Further evidence that corona and radio interference may vary with respect to each other is furnished by photographs (not reproduced). Two series of pictures were made of the corona at the base of the cap of the ground unit of two different three-unit suspension strings. The noise levels were the same for both insulator strings, but one string had visible corona at a level of 5 microvolts, while the other string didn't have visible corona until the noise level was approximately 45 microvolts.

At least three personal factors influence the determination of the corona starting voltage of an insulator. One is the distance of the observer from the insulator, a second is his threshold of vision and the third is his experience in observing corona. Personal safety limits the closeness of approach to the insulator. The threshold of vision varies among individuals and different persons may obtain different corona points. Experience in observing corona is also important. One must train his eyes not to wander in the dark and thereby lose sight of the very faint light as the corona point is approached. Furthermore, as the light becomes fainter one should look to one side of the corona spot as the fovea, the seat of direct vision in the eye, is not sensitive to the very weak light.

The results of five persons observing the same corona at different distances are given in Fig. 9. Each observer made three determinations of the corona point at each distance. There was a considerable range of starting voltage at each distance from the insulator, indicating differences in the threshold of vision and the experience of the observers. As might be expected, the greater the distance from the corona, the higher seemed the corona starting voltage.

For each corona point observation the radio noise level was measured. The results are shown by the limiting curves also in Fig. 9. In the three unit string the noise levels ranged up to 10 microvolts for the corona points observed at 8 ft., while for the single unit they ranged up to 25 or 30 microvolts. It is significant that the noise level of the single unit is from $2\frac{1}{2}$ to three times as great as that of the three-unit string, while the visual corona indicates that the generated radio interference is about the same.

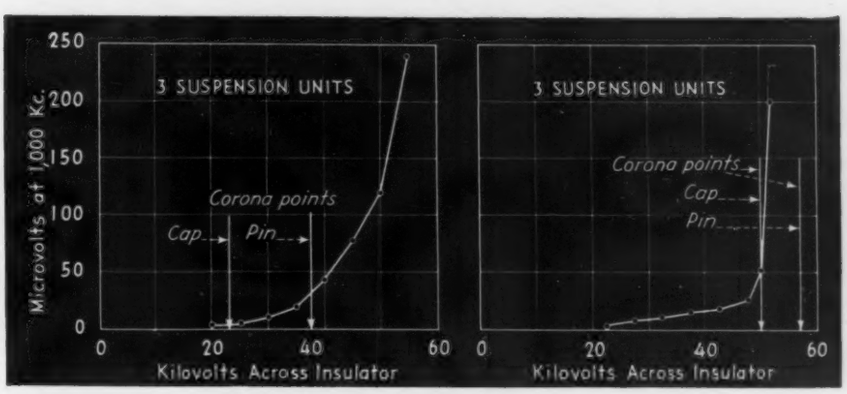


Fig. 8—No exact relation between corona and noise level

is being used extensively as an indication of radio interference and the general opinion seems to be that if one can see corona on an insulator it is unsatisfactory from the radio interference viewpoint. A convenient and reliable method is now available for the direct measurement of radio interference, and as it becomes more widely known it will probably replace the indirect corona method.

The investigation of the radio interference properties of high-voltage insulators by the E.E.I.-NEMA-R.M.A. recommended method has led to the recognition of several factors, all of which are important in using the method. The "warm-up" period, the effect of residual charges, the effect of atmospheric conditions, the effect of ascending and descending voltages and the variation of interference over the broadcast band are all to be considered when using the circuit.

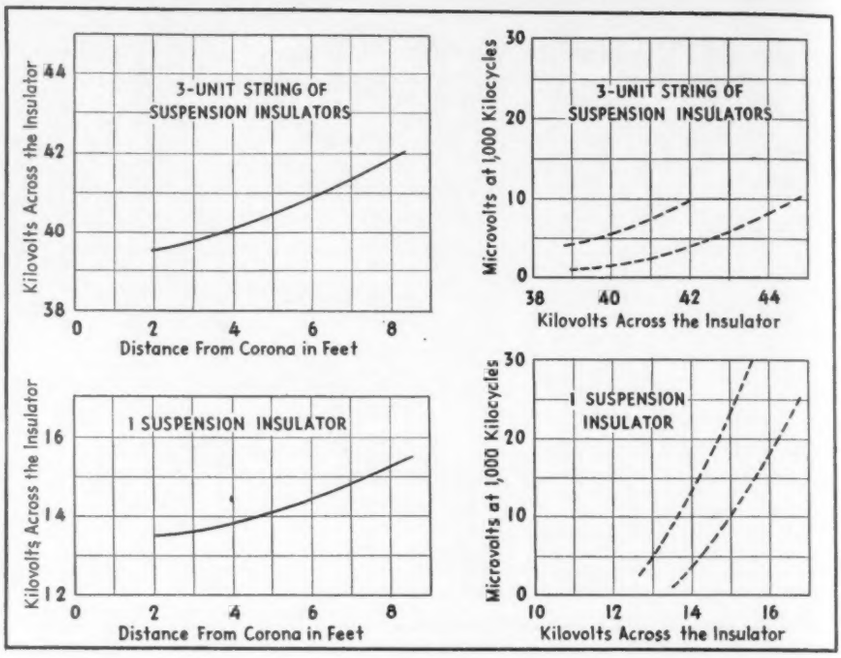

3-UNIT STRING OF SUSPENSION INSULATORS
Kilovolts Across the Insulator
Distance From Corona in Feet
Microvolts at 1,000 Kilocycles
Kilovolts Across the Insulator
1 SUSPENSION INSULATOR

Fig. 9—Visible corona no measure of noise level—These are mean and limiting curves drawn from points established by observations made by different individuals

Warns of Pipe Ahead of Excavating Machine

[*Continued from page 42*]

fraction of an inch there will not be a false signal. The anticipators have been used successfully on ⅜, ½, ¾ and 1-cu.yd machines, ranging from 11 to 18 tons, using standard as well as special heavy-duty buckets for excavating rocky soil, heavy shale and solid rock.

The back-hoe machine, with the anticipator attachment, lends itself well to excavating very close to the service mains and branches without damaging the service members. It can dig with tremendous steady force while depending upon the anticipator to act as the "feeler." The anticipator has been used on old and new clamshell type cranes and multiple-bucket ladder-type ditchers. The slow forward motion and yet rapid full-depth digging feature of the ditchers results in a steady increase of the anticipator signal, thereby permitting the operator to determine very accurately the position of the cross-pipes or cables.

Gratifying Results

During the six months development period of mechanization for duct line work the Public Service Electric & Gas Company kept very exact records of time and costs for machines, trenches, position, condition and material of all pipes and cables encountered. The results listed below for the six-month development period were accomplished while experimenting with various types and makes of machines, tools and devices and while creating a mechanization crew and training new and existing construction forces to the mechanical methods. During this development and recording period 32,000 running feet of trench, large and small manholes and test holes have been dug with the aid of the anticipators:

1. One hundred per cent of the metallic pipes and cables, located by the "Anticipators," were undamaged for 20 per cent of the projects involved; 90 to 97 per cent were undamaged for the balance of the projects. The slightest damage to a service member is listed as "damaged," such as a dent in the lead sheath of a cable, a break in its wood encasement, or a bend in a pipe. Many instances of recorded "damages" have been done by a pick while trimming around the pipes. "Damages" occur after the operator has received the forewarning signal. Experience with the combination machine and anticipator reduces the number of "damages" and using one trained ditch trimmer to follow each machine reduces the damage and expedites the follow-up work. On some jobs 20 per cent of the pipes were extremely rusty and to avoid breaking them, by pushing the earth, the anticipator was set for an "early" signal.

2. All metallic pipes and cables closely approached were signaled by the anticipators before they were uncovered. (It is estimated that the anticipators have located several thousand pipes and cables, to date.)

3. Less damage occurred to service members by the machines equipped with anticipators than occurred with pick and shovel excavation, on directly comparable jobs.

4. The materials of service members located by the "Anticipators" were steel, iron, copper, brass and lead pipes, whether painted, tarred, or rusty; also, wood-encased, lead-covered cables. The pipe sizes varied from ½ to 24 in. Pipes which are tarred, or cables which are wood-encased, generally do not give a signal until the bucket teeth touch, or nearly touch, the encasement, depending upon the "soil" dial setting. This can be improved by merely setting the "soil" dial for an earlier signal. The operator generally sets his "soil" dial for average conditions of soil and bare metallic pipes and cables.

5. Ninety-three to 96 per cent of the required excavation was done by machines as the anticipators permitted the buckets to work much closer to the pipes and cables than would have been possible without the devices.

6. The good-will established with the business houses, residents, local governments and owners of the existing service systems has been an outstanding feature. This was due to less interference with water, gas and telephone services, less time for torn-up streets and less blocking of traffic.

7. Mechanical excavation has progressed successfully with the "Anticipators" under adverse weather conditions, such as rain, sleet, snow and partially frozen ground. The signal device has worked very successfully in trenches 50 per cent filled with rain water.

8. The method is immune to interference from other electrical sources.

Since the development period, exact records have not been kept; however, mechanization in conjunction with the anticipators has expanded and improved considerably. It has been estimated that an additional 108,000 ft. of trench and manholes have been excavated since this development period.

Public Address System Adopted for Power Plant

Voice orders heard above the hum of turbines and other equipment command instant attention and, being heard by more than one man, have more cogency than does telephone communication

A. F. HARTUNG, *Burns & McDonnell Engineering Company, Kansas City, Mo.*

QUICK AND UNHAMPERED communication by means of a two-way public address system between controlling and controlled points in the Quindaro station of the Board of Public Utilities at Kansas City, Kan., is proving its value as a plant operating facility. The station consists of two power houses, No. 1, built a number of years ago, and the newer No. 2, erected in 1932 to house a 10,000-kw. turbo-generator and to which an addition containing a 30,000-kw. unit has recently been completed. The two power houses are operated from a single control room situated in a new switch house built at the time of the recent plant addition. The public address system—Western Electric, 300 watts—is the normal means of dispatching orders to the two turbine and boiler rooms from the control board, although a Selsyn signal and an intercommunicating telephone system are also available.

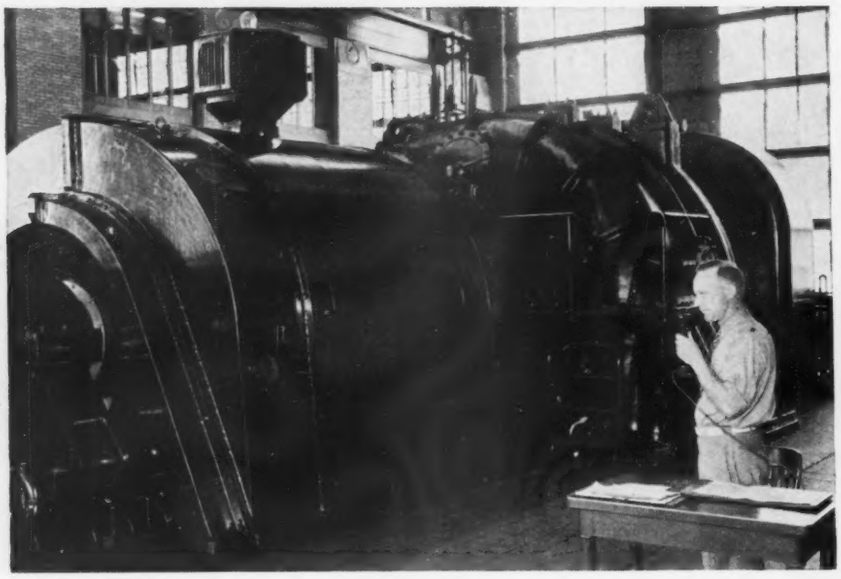
The public address system consists of an amplifier and relay panel, a selector panel installed in the control room and the speakers and microphones mounted in the control room and at the various boiler and turbine room stations. At present there are six stations in the two power plants, besides the control room, one at each of the turbines in plant No. 2 and one at each of the 10,000-kw. turbines in plant No. 1 and one in each of the boiler rooms. In plant No. 2 boiler room a speaker is installed in front of each of the three boiler control panels and all are operated together. In plant No. 1 boiler room a single station consisting of two speakers serves the entire firing aisle.

A small selector panel is installed on the switchboard operator's desk and contains selector switches which permit the operator to call any one or more stations as desired. This panel also contains a master switch which will permit the operator to speak to all stations simultaneously. This master switch feature is designed for use when emergencies arise and has already proved its value on one such occasion. On this panel are also installed two volume control switches, one for controlling the sound level of the incoming calls and the other for controlling the level of outgoing calls. A meter to indicate the level of outgoing calls is also provided on the selector panel. This meter permits the operator to set the volume control switch for outgoing calls to the correct value for his particular voice.

Any of the outlying stations can call into the control room at any time. A push-to-talk switch is installed in every microphone stand, as is also a small red indicating lamp. Microphone stands are of the elder telephone ype. As soon as the push-to-talk switch on any microphone is pressed it is possible to speak immediately to the control room. Pressing the button also lights all the red indicating lights in the other microphone stands, thus showing that the call system is in use. This does not, however, prevent another operator from calling into the control room in case of emergency.

A red indicating light is also provided on the selector panel for each microphone station. As soon as the push-to-talk switch on any outlying station is pressed it lights the corresponding light on the selector panel, thereby indicating which station is calling. The messages are reproduced in the control room by

Selector panel on operator's desk—From this point the operator has two-way communication with plant turbine or boiler rooms either singly or with any number simultaneously. Note the meter on the keyboard for regulating the volume for outgoing calls



Three-way speaker covers turbo-generator operation zone

an 8-in. Jensen speaker mounted under the operator's desk.

In normal operation the switchboard operator selects the station that he wishes to call and immediately begins to speak into his microphone. These messages are reproduced by the selected speaker station. So that there will be no misunderstanding, all orders are repeated and then acknowledged by the receiving station and all orders sent out of the control room are also reproduced by a small speaker installed in the assistant operating superintendent's office.

Details of Equipment

The amplifying and relay equipment is installed in a two-panel inclosed steel rack installed on the main switchgear floor below the control room. There are three amplifiers installed in the rack for outgoing calls, each having an output of 100 watts on class A audio rating. The amplifier in the rack for the incoming calls to the control room has a rating of 20 watts. The capacity of these is sufficient to operate additional stations in the future.

All vacuum tubes used in the public address system are Western Electric long-life type. Further to increase their life the filaments on the tubes are operated at half voltage until any of the push-to-talk switches are closed, which places full voltage on both filament and plate circuits. With such an arrangement a life of more than a year is expected from the tubes. A test meter and push button is provided on each of the 100-watt outgoing amplifiers for checking the condition of the tubes.

The power supply for the public address system is normally from the 115-volt, single-phase lighting service. Power supply to the system obviously must be uninterrupted if the public address system is to be depended upon. A 2-kw. motor-generator set was therefore installed to furnish a.c. power supply to the system if the regular source fails. The motor for the motor-generator set receives its power from the station battery. The transfer to the emergency source is automatic, as is also the transfer back to the normal supply when that is restored.

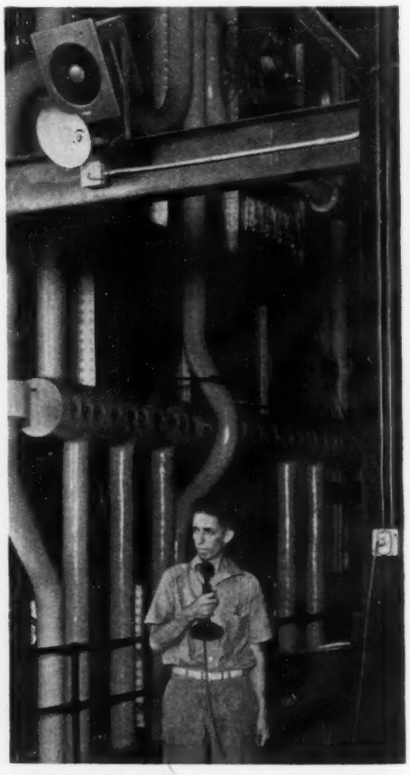
Considerable study was made to determine the best method of reproducing the speech at the various stations, especially in the turbine rooms, in which the noise levels are high and which have tile walls. After numerous tests it was found that the best method in plant No. 2 turbine room was to install three 12-in. extra-heavy Jensen speakers on the generator itself. These speakers are inclosed in a turret mounted on the generator and directed in three different directions to cover the zone of operation around the turbine. By installing the speakers on the turbine speech sounds diminish at the same rate as turbine noises when moving away from the turbine, so that the relative levels of speech and noise remain unchanged.

To aid further in intelligible reproduction of speech, the system was especially tuned to voice tones, with all frequencies below 450 cycles eliminated. Tests showed that the major part of the machine noises occur at frequencies below 450 cycles. Sound reproduced at the lower frequencies would therefore be largely wasted, because the ear becomes ac-

[*Continued on page 105*]

Amplifiers and emergency energy supply

Calls outgoing from the control room are amplified in one or more of the three 100-watt amplifiers on the rack at the left. The other rack, with the blank front, holds the selective relaying equipment and the 20-watt amplifier for calls incoming to the control room. At the left, on the floor, is the 2-kw. motor-generator for sound system energy supply from the station storage battery if the regular 110-volt a.c. supply should fail.



In the boiler room

Speaker mounted on H-beam above attendant, who is about to speak into microphone

SALVAGE!

Reclamation of materials and equipment provides opportunity for work to superannuated and disabled employees, makes real jobs for self-respecting men who do not want to deteriorate in idleness

As Told by **THOMAS S. NICKELSON,** *Detroit Edison Company, to Frank R. Innes*

SOME PEOPLE talk today in terms and words to indicate a belief that human values must ever be in opposition to property values, that if one is given consideration it must always be at the expense of the other. It is not intended here to try to prove the falsity of this belief by argument. Instead, the intention is to demonstrate its untruth by definite, concrete evidence that human and property values are not mutually antagonistic, but on the contrary are mutually helpful. The evidence comes from the materials and equipment salvage operations of the Detroit Edison Company.

Every employer learns, if he remains one long enough, that his indebtedness to his employees is not currently discharged by the payment of wages and salaries. By years of service the employee builds up a moral claim on his employer for consideration and help when adversity comes and when age slows the step. This moral claim is so strong and is so generally recognized that it is in a fair way to become a legal one; has already become so, as a matter of fact. The pension plans, the retirement allowances and the policies of compensation in connection with illness and injury which are so common in American industry, as well as the social security law, are all recognitions of the employer's continuing debt to his employee.

But does the payment of a pension or a retirement allowance, either large or small, constitute complete discharge of the debt to an old employee? Is the generous or the grudging recognition of the employer's responsibility toward his employee in times of illness or injury a sufficient recompense when it is only money, much or little? Many American business institutions, among them the Detroit Edison Company, believe that money payments alone are not complete recompense for faithful service.

PUBLIC RELATIONS SERIES

Men deteriorate in idleness. The greatest tragedy of age, whether in comfort or not, is cessation of activity, withdrawal from the scenes and circumstances of work that heretofore have been a part of living. The old man who does not last long after retirement is familiar proof that unaccustomed idleness is a too frequent precursor of the end. Neither is it good for a man, used to doing, to be idle during convalescence from illness or during partial incapacitation, temporary or permanent, following upon injury. The brooding, querulous unhappiness of doing nothing, forced upon a once active man by injury, is also familiar to all. "Having" is not enough,

Plenty of work for willing men—Bench reclamation of small items such as bolts, braces, sockets, clamps, racks and lightning arresters is done here by incapacitated employees, who return to useful service a surprising quantity of material that looks just about finished when it comes into the shop

The noon hour

whether in terms of mere subsistence, of comfort or of luxury; "doing" is the essential part of living, and man must die without it.

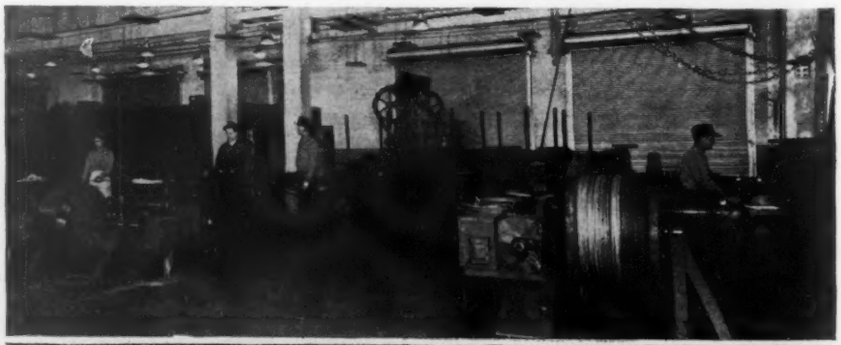
Money payments to men incapacitated from their former jobs by age, injury or illness belong to the "having" aspect of life and alone are insufficient, no matter what they are. Realizing the inadequacy of just money as a recompense for incapacitated employees, the Detroit Edison Company is trying in the best way it can to give these men opportunity to keep on doing, to remain as actors in the scenes that years have made integral parts of their lives. And there is in the matter no flavor of charity nor of benevolence, considering these words in their common meanings as so hurtful to the self-respect of the recipient. The men who take advantage of the opportunity offered them by the company do so in full assurance that their work is worth while and that their pay is honestly earned.

The materials and equipment salvage work of the Detroit Edison Company, as is usual in electric utilities, falls into two divisions. One is the highly specialized work of rebuilding machinery and electrical equipment which is done by manufacturers or in the company shops. Although the idea of furnishing work for older men is carried as far as is possible in this division of reclamation, the work requires such specialized skill as to prevent complete application of the principle. Exclusive, then, of the men engaged in work outside the salvage shop, the general salvage operations of the company employ 110 men, and it is with the work of these men that this discussion and presentation of evidence are concerned.

The accompanying pictures and data give an idea of the scope and magnitude of the salvage work. The total dollar volume of close to a million shown in the table proves that salvage is of significant business proportions, not just something that somebody thought of as an excuse for being good to incapacitated employees. The variety of operations and the opportunities they afford for utilization of skill and experience acquired in former jobs are so many that almost any man might find work with tools and materials familiar to him. The man who handled wire can

Wire on way back or out

Removed overhead line wire is brought in on trays, as shown in the lower picture. It is sorted from these to various other trays according to size, hardness and condition of braid. Very short lengths and badly twisted pieces are sorted out for removing the insulation by burning in the furnace, before selling as scrap copper. The better pieces go on to the wire shop (upper picture), where hard, solid and stranded copper wire, bare and weatherproof, and stranded aluminum wire are sleeve spliced with sleeves developed by the Detroit Edison Company, using a Kearney machine. Soft bare and weatherproof wire is electrically butt welded. Weatherproofing in bad shape is removed by a stripping machine. Bare wire is sent back to the mill for reweatherproofing as needed. Bare soft butt welded wire may also be sent back for redrawing. Salvaged wire is also made into ties, ground rod pigtails and transformer leads.



still handle wire, his pliers still in his hand. The machinist still feels his skill in the repair and reconditioning of tools and machines. Ingenuity and ability to size up a problem and to decide how to solve it are still in demand from the man who cannot now swing his former job and who takes on one in salvage.

Older Employees Used

Of the 110 men employed in salvage, 45 are incapacitated from their previous work by age, injury or illness. More men in this class will displace the younger and more able bodied as occasion requires. There is no reason why practically all of the salvage work may not be done by these men. The work is not often urgent, nor does it often make demands upon endurance or main strength. If a man feels he wants to knock off for a smoke or to sit down and rest a while he knows he can do so without having to dodge the eagle eye of a foreman whose job depends on production. But that freedom from close supervision does not make much, if any, difference in the volume of work done; men who are used to working keep on working, the loafer was a loafer before he got a salvage job.

It may not be assumed, from what is said in this article, that the salvage department is in any sense a hospital for the incapacitated or a home for the aged. In spite of crippling disabilities (injuries, hernia, arthritis, heart trouble, etc.) and of the weight of years (the average age of the older men is well above 60; one man is past 71) the volume and the quality of work done will compare well with the salvage operations of any other utility. Also, no man is offered a job in salvage under any stated or implied condition of "or else." These men are working because they want to work, because they want the money they earn, because they want to hold on to life, not degenerate mentally and physically in idleness. Not all of the superannuated and disabled men in the company are employed in salvage. It is the general practise of the company so far as is possible to keep men in their own departments in surroundings and among fellow workers familiar to them. But when this cannot be done, a job in salvage is offered as an alternative to sitting at home in idleness and as a way to add a welcome increase to retirement or incapacitation allowance.

There is a fitness about salvage work being done by older and by otherwise incapacitated men. These men know, by virtue of their own feelings and experiences, that much value remains in the materials and things that come, broken, worn, frayed and battered, into their hands. They know that they, themselves, are far from finished, and through that

[*Continued on page 105*]

Salvage Volume—Detroit Edison Company

Twelve Months (Sept., '37, through Aug., '38)

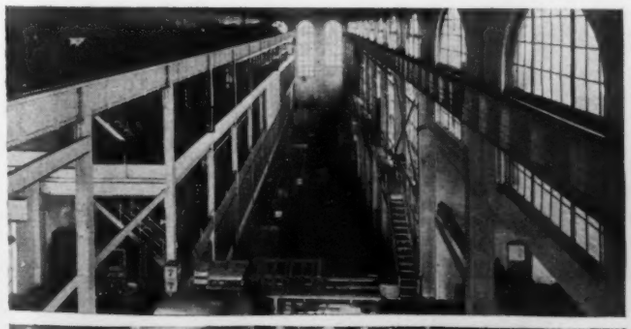
Item	Value
Material salvaged for company's use	$763,754.00
Scrap sold	129,618.00
Material and equipment sold	29,825.00
	$923,197.00

Detail of Certain Important Items

Item	Quantity	Value
Overhead lines items salvaged:		
Arresters	10,089	$72,179.11
Bolts	192,202	12,998.10
Brackets	16,685	3,525.30
Braces	66,801	9,677.47
Clamps	26,013	6,461.24
Connectors	37,922	6,441.90
Fuses	13,016	15,988.17
Insulators	124,724	27,857.06
Hooks	24,500	1,919.80
Pins	27,682	2,396.91
Racks	6,516	4,610.87
Washers	.....	2,112.36
Wire salvaged, lb	1,508,093	245,652.34
Overhead lines tools salvaged	.....	31,657.18
Street lighting items salvaged:		
Transformers	420	10,592.31
Units	649	9,166.72
Lamps	5,218	4,201.34
Poles salvaged	821	8,831.46
Lag heels made	10,377	7,782.95
Crossarms salvaged	8,811	6,689.38
Blocks (spacing, heel, etc.) made	65,317	5,121.53
Line transformers:		
Repaired	7,310	*731,000.00
New coils installed	609	*60,900.00
Three phase converted to single phase and wye-delta four-wire	218	*26,160.00

* Estimated values.

Once turbine room of Delray No. 2—Removed equipment and material is stored here until sold, reused by company or junked



Good men at work on good material—In foreground a load of salvaged wire from which leads and ties are made

Back into stock—Reclaimed items are packed in standard packages, labeled with description, quantity and stock number

Sorting for salvage—Miscellaneous small items, mostly line hardware are received and sorted, then stored awaiting reclamation

STEEL PLANT AND UTILITY

B. M. JONES, *Division Engineer of System Planning, Duquesne Light Company, Pittsburgh, Pa.*

AFTER exhaustive study of its program for development in the Pittsburgh area the Carnegie-Illinois Steel Corporation decided to buy 60-cycle power from the Duquesne Light Company for recent steps in that development rather than to produce all the necessary new power in its own generating stations. The contract, providing for 30,000 kw. in firm power, for additional blocks up to a total of 65,000 kw. under certain conditions and for the taking of dump power by the utility, covers supply of energy for the Irvin and Edgar Thomson works of the corporation. At the former works are a new 80-in. continuous hot strip mill, an 84-in. three-stand cold reduction mill, a 42-in. five-stand cold reduction mill and a 54-in. reversing mill. At the Edgar Thomson works is a new 44-in. universal slabbing mill.

A feature of the interconnection is that it is a direct tie, without transformation, between the 66-kv. systems of the utility and the customer. The substation is of very simple design, as appears in the accompanying illustrations. It is supplied by two three-phase, No. 4/0, 66-kv., 60-cycle, 45,000-kva. transmission lines which terminate on the interconnection substation bus through oil circuit breakers, the station thereby being looped into the transmission system of Duquesne Light. Provision is made for two additional 45,000-kva. incoming lines. The C–I Steel Corporation's two outgoing 66-kv. lines are rated at 40,000 kva. each and are of 300,000 circ.mil copper. All lines terminate on the substation structure, with nine insulators at a point 105 ft. above ground and dry-type arresters installed at each dead end on each line.

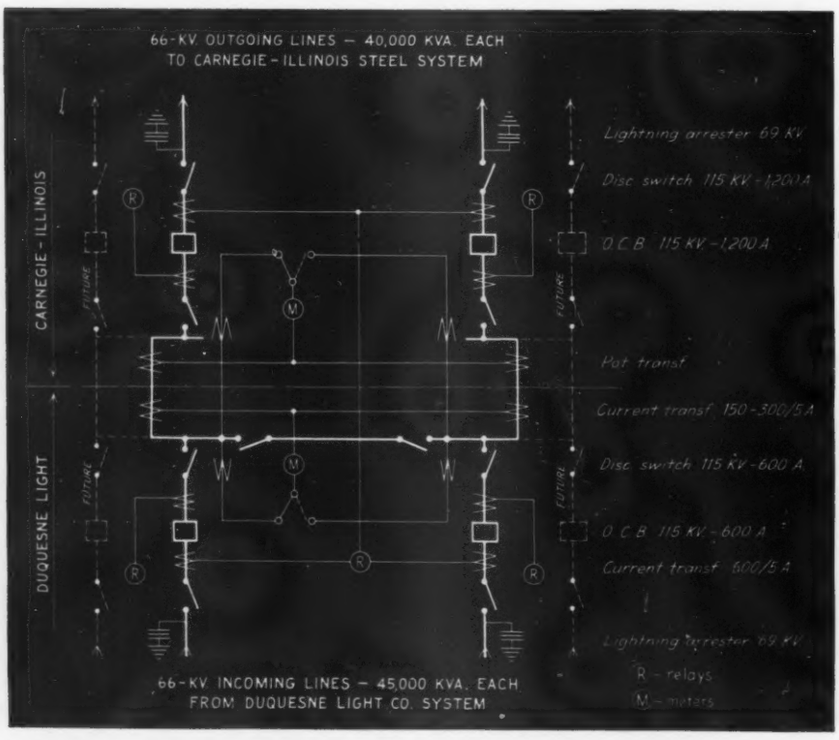


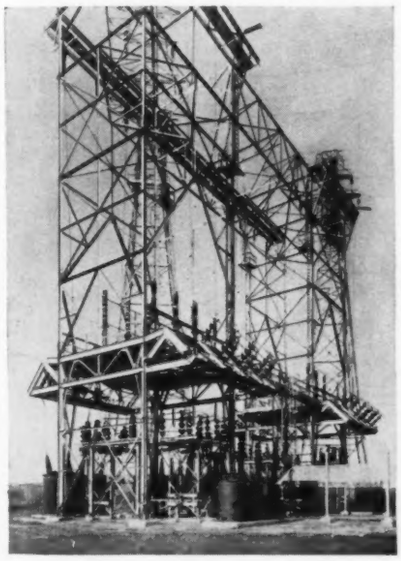
Diagram of direct tie substation

Westinghouse G–2 600-amp. 115-kv. oil circuit breakers, equipped with Deïon grids and adequate relay protection, are used on each Duquesne Light incoming line, with Westinghouse 73-kv. type LV arresters on each dead end, and the customer uses General Electric 1,200-amp. 115-kw., FHKO-339 breakers on each outgoing 66-kv. line, with General Electric 69-kv. Thyrite arresters on each dead end. The 1,200-amp. disconnects and breakers in the steel corporation section of the substation were selected to be duplicates of similar equipment in its other substations. The four line circuit breakers are provided with automatic reclosing facilities, and in addition supervision and control of these breakers is carried on by telephone cable to the system operator's office of the steel corporation, in the upper Duquesne Steel works. Complete supervision, indication and control of the four breakers is therefore in the hands of the steel corporation's system operator, with, of course, jurisdiction pertaining to the Duquesne Light breakers reposing in the Duquesne Light's system operator.

A control house 18 ft. x 29 ft. is located in the substation yard, which contains all meters and relays, on separate panels, and the 132-volt control battery, together with the termini of the pilot wire relay cables and supervisory control cables. An illustration shows the meter and relay panels of Duquesne Light, and relatively similar equipment is used by the customer.

INTERCONNECTED AT 66 KV.

Utility-industrial interconnection in terms of a major system on each side results from tie of lines of Carnegie-Illinois Steel Corporation and of Duquesne Light Company — Contract provides for delivery of firm power by utility and also for the absorption of excess power available from steel mill plants



Close-up of substation

There is a grill or fence about 8 ft. high running through the middle of the second floor of the substation, as can be seen in the pictures, to provide safe working conditions to each company's employees from the other company's adjacent live equipment.

The substation is installed on property of the Union Railroad Company. It occupies ground space of 138 ft. x 241 ft., including the control house, and provision for four more line breakers, two on each side. Complete access to the substation is available to both companies, with the exception of the control house, and here each company has its own meter and control room under separate lock.

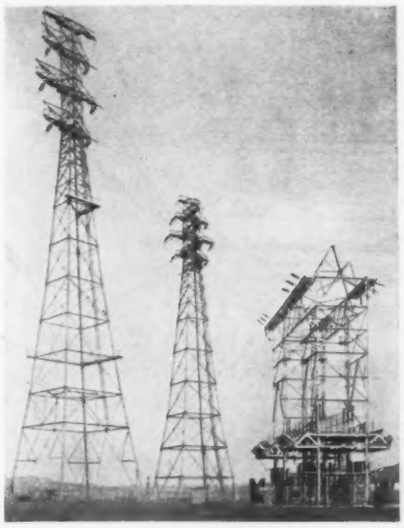
Passing within ½ mile of the interconnection substation are four 45,000-kva., 66-kv. Duquesne Light lines, one of which is cut and looped into the interconnection substation, thus providing two 45,000-kva. lines for service to the steel corporation. Provision has been made for ultimately providing two more 45,000-kva. incoming lines by cutting and looping another line into the interconnection substation, and the line towers and substation structure have been laid out to accommodate these two lines at minimum expense.

The Carnegie-Illinois circuits form a loop system, one side of which extends from the substation to the Edgar Thomson Works and then continues from this point to the Irvin Works. The loop is closed by continuing this line from the Irvin Works back to the interconnection substation. Provision has been made for tying other works in the district into this loop and for possible additional circuits.

The two 40,000-kva., 60-cycle lines are carried on double-circuit steel towers using five insulators in a string, with twin strings of ten units on river crossing towers. In addition, blow-out tubes are used on the strings on the river crossing towers.

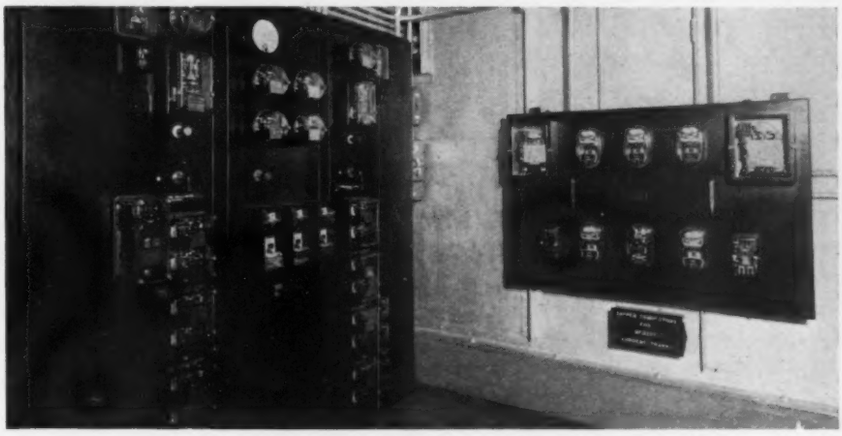
An item of unusual interest in this transmission system is the large 60-

[*Continued on page 104*]



Substation is of simple design

Note the wire fence running through on the upper level of the structure. This barrier for protection of workmen against energized equipment on one or the other side divides the substation into Duquesne Light ownership, right, and steel corporation on the left. At the left is a 310-ft. river crossing tower which carries the two steel corporation 66-kv. lines from the substation. The other tower is unrelated, carrying circuits of the corporation's 25-cycle system.



Relay and meter panels of Duquesne Light in control house

Editorials

S. B. WILLIAMS, *Editor*

Tennessee Goes to School of Experience

THE LOSS to public operation of the state of Tennessee was a major blow to private utilities, but the experiences that come out of it may in the long run prove to be a blessing. The people of Tennessee were lured by cheap power. Now they have it in part of the state and expect before long to have it throughout the state. But with it has come the realization that it isn't the same service. In other words, they are learning that you get about what you pay for, and in cases of extreme cheapness you don't always get that.

Private utilities paid several millions of taxes. The counties where TVA property is located have lost much of their income. The people are now beginning to learn that the rates of private utilities covered more than service.

The people of Tennessee are also beginning to ask who is going to make up the donations to charitable organizations, to civic groups, etc., which the power companies formerly gave. In many a way is the public learning of the generosity of the power companies and the things they did to build the community financially, economically and socially.

And, next, the people will learn the difference in service, in the attitude of employees, in the desire to be helpful. When the rates are low you can give just about so much, and that will be the situation in Tennessee.

How can the lessons be brought home to the public elsewhere? Cannot the charge for electric service somehow be broken down into its component parts? From time to time it has been suggested in these columns that perhaps a separation might be made between service and taxes. It might also be possible to segregate occasionally some of the other items that load down the cost of service. It is realized that this involves an almost impossible feat in accounting and it is possible that it cannot be done. Nevertheless, it should be worth a try, for if it is possible to make such a breakdown, it might be a very effective way of silencing the rate critics.

Public Ownership Loses Two Able Leaders

WITHIN the past week or two public ownership has lost two of its most able men, Thomas A. Panter, electrical engineer, Bureau of Water, Power and Light of Los Angeles, and J. D. Ross, Bonneville Administrator. Few men have done more to advance municipal ownership in this country constructively. Contrary to the experience in so many cities with municipal ownership, in Los Angeles and Seattle, where these men operated, the public property was run with full intent to serve well the customers and the community.

It is seldom that a municipal property makes any contribution to the advancement of the art, being content as a rule, because of its political character, to operate as it has always operated. In Los Angeles and Seattle, however, the municipal organizations were constantly being encouraged to seek out and, if necessary, initiate better and more effective practices. In both places progressive methods of load building based upon market knowledge were employed, which also is unusual with municipal undertakings.

While it was not possible always to agree with the elements of utility philosophy expressed by these men, they had to be respected by the private utilities as opponents worthy of the best defense. They have both been makers of electrical industry history.

Fluorescent Lighting a Supplement, Not a Competitor

UNTIL very recently the utilities had, for most practical lighting purposes, only one light source with which to meet the varied lighting requirements of their customers. This source was their mainstay throughout more than a quarter of a century of lighting progress, and it will continue to be their mainstay, surely for a goodly number of years to come.

It was inevitable, in a field backed by so much distinguished research, that one day we should have new light sources which would supplement the incandescent filament lamp. The fluorescent lamp is the newest, and perhaps the most generally applicable, of these supplements, and as a supplement it should be regarded.

We need to develop a point of view in the industry that will enable us to make the most of the new choices that are at our disposal. We are not going to make sound progress if we recommend incandescent filament lighting when analysis would indicate that fluorescent lighting is best, nor if we recommend fluorescent lighting in every case where we find a customer willing to experiment. After all, what is best for the customer is best for the industry that serves him, and this means that the lighting salesman of today must analyze each job to determine the economics of one type of lighting compared with another.

We know that fluorescent lamps have a number of

particular advantages over filament lamps, notable among which is their ability to produce cool foot-candles of daylight quality. This characteristic alone is a factor of great importance to the utility, for it enables it to bring to customers, who have been stymied because of the high cost of wiring, the improved lighting so long desired. Any one who has studied the effect of improved illumination on load knows that when a customer substitutes good lighting for poor lighting he increases his hours of use markedly.

The fluorescent lamp is a real ally of the air conditioner. Its high efficiency makes it almost ideal for use in both old and new interiors where air conditioning is being considered. It is an unfortunate fact that filament lamps generate a considerable amount of heat which becomes a load on the cooling system. This inherent difference between air conditioning and light conditioning has impeded the progress of both, for the average business man feels he has to cut some place and he frequently winds up dissatisfied. Being a cool source, the fluorescent lamp offers an answer to this problem. Its value, too, in those interiors where the air conditioning is already installed and operating to capacity is readily apparent.

The fluorescent lamp has its limitations which exclude it from many important fields. There are, however, numerous instances where the advantages of fluorescent lighting are so desirable that the present limitations, with respect to initial installation expense, are washed out. Today the public is paying about a million dollars a month to get fluorescent lighting, and it is up to all concerned to see that this new light source is properly recommended and properly used.

The No. 1 Fire Hazard

CHIMNEYS, defective heaters and cigarettes have given way to electricity as the No. 1 fire hazard. In the October N.F.P.A. quarterly the annual compilation of fires shows the loss from fires of electrical origin—defective wiring and appliances and motors—to outrun all others. In numbers of fires, those of electrical origin stood third, being smaller than careless smoking, which was first, and chimneys.

The data cover twelve states and therefore are not complete. These states, however, were chosen by the author, D. E. Nolting of the N.F.P.A. Department of Fire Record, because they contained the most complete classification. The data are believed to be fully indicative of the relative cause of fires.

Out of a total of 270 millions fire loss reported from the twelve states, 90 million of which was from fires of unknown origin, 29.3 million was electrical in origin. This figure divides into 23.5 million from defective wiring and 5.8 million from appliances and motors.

In other words, some 16.3 per cent of the 1937 fire loss was caused by electrical fires.

How much of the fires of unknown origin was electrical, of course, will never be known. It might be noted, however, that records kept for several years by the New York Board of Fire Underwriters revealed that a large percentage of fires of unknown origin occurred in buildings that were on bulletin as having defective wiring.

The twelve states have a population of 35 million. On that basis, and giving some consideration to fires of unknown origin, it is obvious that the 1937 fire loss in the United States from electrical causes exceeded one hundred million dollars.

This figure is eloquent in its plea for reinspection. The industry can render a great service to the public by co-operating to secure reinspection—and at the same time help itself.

Reinspection will provide work for wiremen, sales for manufacturers and wholesalers and better consumption of energy for utilities. A building burned down is a lost current customer.

Our New Dress

FOR THE past six months one of America's best graphic designers has been studying the typography of ELECTRICAL WORLD in order to create a design that was in harmony with its purpose, to speed up readership, to make reading pleasanter. We present the results with this issue.

It will be noticed that structurally the magazine is not altered. The order has been maintained. The character of material, the departments—all are as they were. Just the vehicle for delivering the product has been changed in appearance.

Many standard products have been redesigned solely for appearance. Stores with the same stock are being modernized. It is a new age that, in spite of all its complications, is nevertheless simple in taste. Life is faster today, there is less time to do our business. If we are to accomplish as much or more, we must speed up our operations. We must streamline what we do. And that is modern design.

This new streamlined design for ELECTRICAL WORLD has, through shorter lines, better use of contrast and type color, better use of illustrations, greater margins and more white space, made reading easier and faster. Nor has everything been sacrificed to utility, for, like all good streamline design, its simplicity and balance give it distinction and beauty.

For those who might be interested in type elements, we have continued Old Style for body text with Modern for display, using Bodoni book, Bodoni italic, Karnak, Memphis and Vogue. A few years ago the use of so many faces would have been considered very bad design. But a few years ago the girls all wore a single color treatment in their new spring outfits. Today, however, designers of clothing have achieved a freshness through change of pace, and withal there is a pleasing harmony. Graphic design has likewise found it necessary to have a change of pace, and through the judicious use of different type faces with color balance achieves harmony.

A Norris Constituent Looks at TVA

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

PRESIDENT TAFT once said that the way to keep a secret really confidential was to put it in a White House message to Congress—it would be abundantly printed, but no one would read it. More accurately, it might be said today that the way to bury an interesting fact is to put it in a government bureau report. Especially as even the newspaper men supposed to digest such masses of details for the benefit of their readers are so busy that they too often rely on the "stories" written about the reports by the press agents of the bureaus in question.

But a constituent of Senator George W. Norris comes forward who has actually read and studied the report of the Tennessee Valley Authority for the year ended June 30, 1938. This constituent of the head of the public power bloc in the Senate is W. R. McGeachin, contract manager for the Iowa-Nebraska Light & Power Company, so perhaps one might be justified in suspecting that he does not see eye to eye with Senator Norris on the question of public ownership in the electric business. One might even suspect that this "Believe It or Not" instance of a gentleman who actually read a government report does not display the cold, judicial impartiality which the case merits. But be that as it may, his figures and his deductions are of sufficient importance to the entire electric industry—and for that matter to every one who pays taxes—to justify a little checking to see if his deductions are not accurate.

In addition to analyzing the report with reference to power production Mr. McGeachin has gone into the other activities of TVA, such as navigation, flood control, fertilizer production, development activities, etc., and finds that they show an operating loss for the year of $4,700,000—*after* crediting the TVA with the fertilizer sold.

"The investment in TVA facilities other than power," says Mr. McGeachin, "amounts to $168,000,000, which at 4 per cent interest cost the taxpayers of the country $6,720,000. This means that the cost to the taxpayers of the activities of the TVA other than power was $11,420,000. The loss according to my analysis for power production amounts to $10,793,000, making a total annual cost to the public of $22,213,000. This is approximately what it takes to run the entire Nebraska state government for one year."

Here is Mr. McGeachin's table of figures, taken from Exhibit IV of the TVA report:

Revenue	
Power sales	
Municipalities	$545,690.12
Electric utilities	196,767.48
Industrial	918,565.20
Rural (retail)	154,154.56
Interdepartmental sales	490,699.49
Other revenues	49,394.78
Total revenues	$2,355,271.63
Expenses	
Operation	$899,799.99
Maintenance	221,532.32
Payment to states (Note 1)	93,246.69
Depreciation (Note 2)	1,048,216.52
Miscellaneous	16,775.92
Allocated portions of common expense, Schedule C	385,871.84
Total expenses	$2,665,443.28
Deficit, not including interest	310,171.65

"The total TVA investment," Mr. McGeachin points out here, "consists of $191,066,270 appropriated by Congress since June 30, 1933, and $132,792,294.03 cost of Wilson Dam, steam plant, etc., turned over to TVA by the War Department. Total $323,858,564.03. The cost of property allocated to TVA power developments is approximately $155,000,000."

Fixed charges (less TVA depreciation item)	$10,483,536.79
Total deficit	$10,793,708.44

"If the yardstick is to be fair," Mr. McGeachin points out at this point, "fixed charges should be approximately 7½ per cent (interest 4 per cent, depreciation 2 per cent and taxes and insurance 1½ per cent) which figures are used in this statement."

And to this tabulation he appends the following notes:

1. The TVA pretends to pay taxes. If a private utility owned the TVA it would be taxed approximately $1,500,000 per year. The TVA carries no insurance.
2. The depreciation charge of $1,048,216 is obviously too low, 0.67 per cent of the investment of $155,000,000. If an adequate depreciation (2 per cent) on the actual power investment were used, this charge would be $3,100,000.
3. Interest is casually mentioned on page 14 as follows: "The authority has incurred no interest expense, hence has recorded none on its books."
4. The certified public accountants' statement which accompanied the TVA report contained the following with reference to the allocation of investment for navigation, flood control and electric power: "We express no opinion respecting such allocation of property investment and of common expenses."
5. $874,618.95 has been spent by TVA under the heading "Information Office" (propaganda). Only 5.1 per cent of this is charged to electric power. (Schedule G.)
6. $217,892.01 has been spent by the TVA under the heading of "Washington Office." Probably lobbying for additional funds. (See Schedule G.)

Mr. McGeachin's statement of TVA earnings for the years ended June 30, 1935-36-37-38 is given in the accompanying table.

TVA Earnings Statements for Years Ended June 30, 1935, 1936, 1937 and 1938

	1935	1936	1937	1938	Total
Power investment (Note 1)	$75,000,000.00	$100,000,000.00	$145,000,000.00	$155,000,000.00	$155,000,000.00
Operating revenue	563,469.17	1,170,505.13	1,654,025.42	2,355,271.63	5,743,271.33
Operating expenses	383,398.77	540,223.85	939,404.24	2,665,443.28	4,528,470.14
Operating net income	180,070.40	630,281.28	714,621.18	—310,171.65	1,214,801.21
Fixed charges	4,225,000.00	7,500,000.00	10,875,000.00	10,483,536.79	33,083,536.79
Deficit	4,044,929.60	6,869,718.72	10,160,378.82	10,793,708.44	31,868,735.58

Note 1—The total TVA investment consists of $191,066,270.00 appropriated by Congress since June 30, 1933, and $132,792,294.03 cost of Wilson Dam, steam plant, etc., turned over to TVA by the War Department, Total $323,858,564.03. The cost of property allocated to TVA power developments is approximately $155,000,000.00. If the yardstick is to be fair, fixed charges should be approximately 7½ per cent, (interest, 4 per cent, depreciation 2 per cent, taxes and insurance 1½ per cent), which figures are used in this statement.

Note 2—All figures used in these statements are from published TVA reports, except investment and fixed charges.

NEWS OF THE WEEK

New Sales Market Approach Seen Way to Higher Revenue

Chairman Dexter tells Edison Electric Institute sales meeting in Chicago that low-use customer business can be made profitable — See unprecedented load-building opportunity

GREATLY INCREASED revenues for the public utility industry can be inaugurated at once through new approaches to the tremendous market potential represented by the low-use, currently unprofitable customer, Harris E. Dexter, general chairman, told 200 members of the Edison Electric Institute sales committee this week at the annual conference held at the Edgewater Beach Hotel, Chicago.

To management and sales executives responsible for producing gross and net earnings and now selling new residential kilowatt-hours for 1½ cents, Mr. Dexter spotlighted the unprecedented opportunity for load-building in the low-use brackets which could double the gross receipts in this classification per kilowatt-hour.

Referring to experience of his own Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y., Mr. Dexter said this company collects 180,000 nickels per month from customers who are buying components for modern electric kitchens. Forty-two per cent of the appliance sales in 1938 were paid for by customers dropping two or three nickels a day in a slot. Customers are buying small water heaters and refrigerators on this plan only, the speaker cautioned, after the customer's needs were analyzed, his capacity to pay measured and appliances to fit his needs and income had been conceived, designed and produced.

A similar objective analysis of today's electric range would result in radical departures in design and in wider opportunities for profits for manufacturers as well as utilities, Mr. Dexter predicted.

Charles W. Kellogg, president of Edison Electric Institute, sounded a similar note in reminding utility sales executives of their joint responsibility with engineers for investment efficiency. To further the financial good health of our utility organizations, sales people will co-ordinate their efforts with existing facilities, Mr. Kellogg stated.

With the goals of utility selling effort thus summarized, Max Fisher, assistant secretary Metropolitan Life Insurance Co., outlined ways and means of organizing the selling effort. The general opening session was concluded by a summary of today's problems and opportunities in the rural market by Grover C. Neff, president Wisconsin Power & Light Co.

SALES CONFERENCE—Utility sales executives gathered in Chicago this week for the annual E.E.I. meeting. L. to r.—R. Freeman Barnes, General Electric; O. Rodney Doerr, Pacific Gas & Electric; Edward D. Stryker, General Electric, and C. C. Curtis, Savannah Electric Co.; Davis M. DeBard, Stone & Webster Service Corp.; and Charles E. Michel, Union Electric Co. of Missouri.

At the second general session, held Wednesday morning, Mrs. Mary Gillies of *McCalls Magazine*, again drew attention to the valuable contributions which could be made by utilities and manufacturers through a better knowledge of the modern home-makers' requirements. An analysis of the possibilities of increasing dealers' sales, predicated upon the tendency of utilities to turn more sales over to dealers, was presented by Kenneth Dameron of Ohio State.

J. M. Follin, Federal Home Building Service, speaking of the home market of tomorrow, pointed to the great significance of recent trends toward the lower-priced homes sold to and occupied by the masses of people of moderate means. Carl M. Snyder, General Electric Co., spoke on "A New Standard of Electrical Living."

At the general sessions, Thursday, J. R. Pershall, advertising and merchandise sales manager of Public Service of Northern Illinois, stressed the natural alliance between selling and advertising and demonstrated the benefits which arise from their development along complementary lines. Dr. Albert G. Young of Corey Hill Hospital, Brookline, Mass., showed how air conditioning in operating rooms and patients' quarters had practically wiped out cases of post-operative pneumonia.

Pointing out that the sales job faced by Consolidated Edison may be different from that faced by other utilities, Ephraim F. Jeffe, vice-president, described the conception of package sales at reduced prices and summarized results of sales campaigns.

At the Thursday afternoon general session Harold Dinkins, Ebasco Services, gave a diary presentation of the general commercial situation to illustrate the unsold market still existing with respect to the commercial customer. Henry J. Morton, Detroit Edison and recently roving consultant on wiring to utility companies, summarized the problems met with respect to inspection bodies, organized labor, etc., in connection with new wiring standards; V. M. F. Tallman of the Tenney Organization presented a non-technical report upon the scope and direction of Diesel competition based upon recent developments in the Diesel field.

LOAD BUILDING—Harris E. Dexter, sales committee chairman (left), with E. H. Stahl, Pacific Gas & Electric

Position of Utilities

At the formal luncheon, Wednesday, Bernard F. Weadock, vice-president and managing director Edison Electric Institute, evaluated the position today of the public utility industry in the national scene.

Mr. Weadock sounded a new note of courage in pointing to the difficulties of the industry when it first began to operate and the waning political support of punitive legislation and the waning public interest in political criticism of the public utility business.

In addition to the general sessions, Tuesday afternoon was devoted to a Better Light-Better Sight session and Wednesday to the Modern Kitchen Bureau, the latter presided over by George Whitwell, vice-president Philadelphia Electric Co.

R. C. McFadden, Southern California Edison, presented results of kitchen load-building procedures in Los Angeles, and J. R. Poteat, General Electric, spoke on electric ranges and R. M. Oliver, Westinghouse, on roasters.

Fluorescent lighting, school lighting and decorative lighting were subjects of the Better Light-Better Sight conference, with John Mueller of West Penn Power summarizing the problems and possibilities of fluorescent lighting to utilities. V. E. Dioner, superintendent of schools, Fremont, Ohio, showed the contributions to good scholarship of good lighting, and Harry V. Anderson, editor of *Interior Design and Decoration*, spoke on the possibilities of decorating through the broader use of lighting.

All sales committees held preliminary meetings on Monday and a dinner of the general sales committee was held that evening.

Friday was devoted to closed sessions on power sales.

Mr. Dexter appointed J. E. North, manager of domestic sales of Cleveland Electric Illuminating Co., as new chairman of the Better Light-Better Sight Bureau, committee, to succeed Charles A. Eastman of Ebasco Services.

Decatur Starts Service

Decatur's (Ala.) new quarter-million-dollar municipal electric distribution system began service to residential customers on March 15. Mayor R. N. Harris was the first to be served.

AFTER MORE SALES—More profitable load is being sought in sales drives of utilities this year as indicated by the Chicago sales meeting speeches. L. to r.—M. N. Waterman, Central Hudson Gas & Electric; Oscar P. Cleaver, Westinghouse Lamp Division, and D. C. Hornig, Pennsylvania Power & Light; R. C. Cosgrove, Westinghouse; A. H. Stack, Ebasco Services, Inc.; W. H. Thompson, Westinghouse, and O. M. Jackson Georgia Power

Curb on Capital Markets Seen Retarding Recovery

Chairman Carlisle tells stockholders that business cannot expand unless new financing can be accomplished — Made $6,000,000 annual saving in refunding

THE MAJOR OBSTACLE to business recovery in this country is the inability of the security markets to operate normally, Floyd L. Carlisle, chairman of Consolidated Edison Co. of New York, Inc., told stockholders at the annual meeting this week.

Mr. Carlisle declared that industry cannot expand and operate at high rates unless adequate financing can be done in the capital markets free from incumbrances. He said that before the new laws were passed enormous machinery was available to sell securities. The legislation that was passed absolutely killed all selling of securities, through subsidiaries, by banks which had deposits, Mr. Carlisle pointed out.

Against Restrictions

"Personally," Mr. Carlisle said, "I think it would be a very bad thing to further hamstring the mechanism or machinery through which securities are sold." He emphasized the fact that taxes will never be reduced and prosperity cannot be fully attained until industry can sell to the American people out of their accumulated savings five to ten billion dollars of new securities.

Consolidated Edison has given no consideration to competitive bidding on new security issues, Mr. Carlisle said. The company does not contemplate any new financing in 1939 or 1940. He said that the company effected a saving of $6,000,000 annually through the refunding program.

The large number of stockholders at the meeting received with a great deal of satisfaction the statement by Mr. Carlisle that Consolidated Edison will benefit as much as any business from the World's Fair. He said that the company will spend about $1,250,000 on its exhibit if the fair runs for two years. He expects every Edison customer to visit the exhibit at least once. Sales of gas and electricity to the fair will total $2,305,000.

Sees No Diesel Threat

In reply to a question concerning competition from individual Diesel private plants, Mr. Carlisle said that there had been no invasion of any consequence. "We have had such competition for many years," he said. It was pointed out that some plants have been taken out and replaced by Edison service. He said that the threat of Diesel competition is not considered of any consequence.

Mr. Carlisle gave the stockholders a detailed explanation of the labor situation and the case which was finally decided by the Supreme Court. There were CIO representatives at the meeting, as stockholders and employees, who attempted to open a discussion of labor policies, but Mr. Carlisle informed them that the meeting was no place for such "attempts to raise a labor disturbance."

•

Seek Rhode Island Rate Survey Ruling

Governor Vanderbilt of Rhode Island has requested state Attorney-General Jackvony for an opinion as to the responsibility of public utilities for meeting the cost of a $225,000 rate survey completed last year by Frederick A. Young, former head of the regulating commission of that commonwealth.

Horace L. Weller, director of the Department of Business Regulation, recently informed the Governor that the Narragansett Electric Co. did not consider itself liable for assessment, and that the Newport Electric Corp. is of the same opinion. The Blackstone Valley Gas & Electric Co. advised Benjamin M. McLyman, public utility administrator, that it had verbally agreed to contribute toward the cost of the survey on the condition that other companies share the expense.

Governor Vanderbilt said last week that allowance for the collection of the $225,000 had been made in his budget, and that if the Attorney-General substantiates the position of the utilities it will be necessary to raise the money by taxation. The power companies contend that as no public hearings were given during the Young investigation no liability can legally be placed upon them for meeting its cost.

•

Loses Decision in Fight on Commission Assessment

Suit of the Bradford (Pa.) Electric Co. against assessments placed on it by the state Public Utility Commission for expenses of the regulatory body was dismissed as "premature" by the Dauphin County Court at Harrisburg, Pa. Judge Frank B. Wickersham handed down an order refusing to enjoin the commission from assessing and attempting to collect $1,085 from the company, a subsidiary of the Associated Gas & Electric Co.

The company sought an injunction, claiming that the sum assessed as its share of the commission's expenses for the fiscal year beginning June 1, 1937, was a tax, constituted an illegal dele-

REPORT TO STOCKHOLDERS—Floyd L. Carlisle, chairman of Consolidated Edison Co. of New York, Inc., addressing stockholders at the annual meeting this week. David C. Johnson, vice-president (left); Harold S. Sutton and Herbert C. Davidson, vice-president (right). More than 400 stockholders were present

gation of power on the commission and deprived the company of its property without due process of law. Judge Wickersham said the issue should first be heard by the commission as prescribed in the utility law before it enters a court. He did not rule on the constitutionality of the law.

•

Form Dealer Group to Sell Appliances

More than 100 dealers in electrical equipment recently organized the Inland Empire Electrical Equipment Association for the specific purpose of reaching a $3,300,000 sales market this year.

Lewis A. Lewis, assistant general sales manager of Washington Water Power Co., is secretary of the new organization, which represents all phases of the industry. Mr. Lewis stated that in 1923, with 4,000 water heaters in service, there were 31,000 customers not using the service, and in 1937, with 18,000 water heaters in service, 47,000 customers were not using the service. He said that the same trend holds to I.E.S. lamps and ranges.

According to Kinsey M. Robinson, president of the utility, at least half of a $100,000 advertising budget would be placed at the disposal of the new dealer association of "use" advertising and to be run over the association signature.

•

RFC Seeks Knoxville Bids

RFC has called for bids on a $214,000 issue of city of Knoxville, Tenn., 4 per cent electric light and power system bonds.

Named to Court

SEC Chairman Douglas will be youngest on bench

William O. Douglas, chairman of the Securities and Exchange Commission, was nominated by President Roosevelt to the Supreme Court vacancy recently created by the retirement of Associate Justice Louis D. Brandeis. The 40-year old SEC chairman, if confirmed by the Senate, will be the youngest to sit on the tribunal in more than a hundred years.

Utility officials are highly interested in who may be appointed as the successor of Mr. Douglas. Hearings on the proposed plan of integration of Columbia Gas & Electric are to be held by the SEC on April 3. The American Gas & Electric plan is soon to come before the commission. Actions in these two cases are expected to set precedents for other utility systems.

Mr. Douglas has always taken a conciliatory attitude toward the problems of the utilities in meeting the requirements of the holding company act. Just how far this attitude will prevail after Mr. Douglas leaves the SEC is open to speculation.

•

Launches Campaign to Promote Roaster

During March the Modern Kitchen Bureau launched a comprehensive campaign for the electric roaster which will extend over a period of three years. In 1938, the electric roaster moved in to fifth place in the number of sales of all appliances selling for $20 or more. That several million will be in operation before very long is the opinion of manufacturers, who see a new "Golden Age" in appliance selling and revenue building ushered in by the electric roaster.

The theme of the heavy national advertising which broke this month is "Easier Cooking—Easier Living." The time selected by the Modern Kitchen Bureau for strong local promotions tying-in with this national broadside is the month of June, with a second electric roaster showing scheduled for November 15-December 15. The bureau has also created a full array of sales helps as part of the promotional machine. A complete dealer plan book, outlining the whole program, can be had without charge from the Modern Kitchen Bureau by utilities who plan to organize dealers in their areas and do an electric roaster job.

•

McCarter Asks Shift in Post with Utility

Will leave presidency after 36 years — Board to create chairmanship

Thomas N. McCarter, president and founder of the Public Service Corporation of New Jersey, this week requested the board of directors to relieve him of his duties of president, a position which he has held for 36 years. He recommended that a new office be created, chairman of the board, a post which he said he would be glad to fill because of his long service and familiarity with operations of the corporation.

Reasons for Action

Mr. McCarter gave four reasons for asking to be relieved of the routine duties as president. He expressed belief that 36 years was long enough for any one man to occupy any one executive office, his age, 71, and the desire to take life a little easier despite continued good health; the corporation and all its properties are in first-class condition from both the economic and operating standpoints, and there are other senior officers in the organization who have given their lives to the corporation who should be considered before it is too late.

It was pointed out by Mr. McCarter that the simplification of the corporate structure is almost completed, and the remainder of it is all planned. He expressed the hope that the virulence of the governmental attack upon the electric industry has passed.

A committee was appointed to work out details of the proposed change and to report at the annual meeting on April 18. The board has approved the plan.

ADVANCED LIGHTING COURSE—More than 100 utility representatives from all parts of the country gathered at the recent advanced lighting course for experienced commercial and industrial lighting salesmen conducted by General Electric at Nela Park

Niagara Hudson Units to Expand Facilities

System to spend $25,000,000 on new construction — Start Oswego plant

Operating companies in the Niagara Hudson Power Co. system will spend about $25,000,000 during 1939 for construction necessary to the extension and improvement of service to electric and gas customers in New York State, Alfred H. Schoellkopf, president, announced last week. This compares with about $15,000,000 spent in 1938.

Mr. Schoellkopf pointed out that of the planned expenditures this year, about $8,000,000 is to go toward the construction of the new steam-electric generating station now being built at Oswego, N. Y., by Central New York Power Corp., in preparation for anticipated growth in demand.

The remainder of the contemplated expenditures includes many construction and replacement projects, such as construction of and equipment for additional substation units; building overhead transmission lines and underground circuits and mains; additions to the electric and gas distribution systems to supply increased business on existing lines; extension of lines to serve new customers, and installation of new or improved street and highway lighting.

•

Kansas City Power & Light Boosts Automatic Stokers

Kansas City Power & Light has taken the leadership in boosting the sale of automatic coal-firing devices. It is said that the company is the first utility to endorse and promote automatic coal stoker heat as an electrical appliance.

Coal men in Kansas, Missouri and Oklahoma are united to boost the stoker in co-operation with the utility. A $15,000 campaign fund has been raised.

•

Names Three New Officers

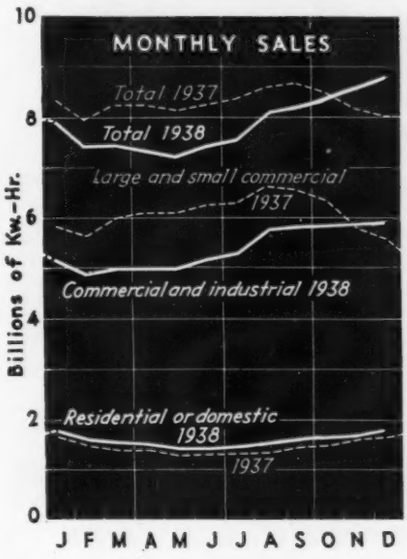
Connecticut Light & Power this week named three new vice-presidents: J. E. King, charge of operations; A. V. S. Lindsey, charge of sales, and A. J. Campbell, Waterbury. Irvin W. Day was elected a member of the executive committee in place of his former position as vice-president, and Robert W. Knowlton, vice-president since 1927, elected executive vice-president and general manager.

Other appointments include C. J. Allen, manager Waterbury district, as director of public relations; William T. Jebb as new manager of Waterbury district, and Calvin T. Hughes, general engineer, becomes general superintendent, and Robert T. Stacy, Hartford office, becomes executive assistant.

•

Utility Revenue Rises to New High

December revenue of the electric light and power industry rose to the highest monthly figure ever attained, energy sales amounting to $197,111,200, other revenue $1,879,500, making a total of $198,990,700, according to the Edison Electric Institute. The first of these items, which are based on the F.P.C. classification, corresponds approximately with revenue from ultimate consumers, E. E. I. classification, which attained a peak of $189,990,100 in January, 1937. This has now been exceeded by 3.7 per cent. The corresponding revenue in December a year ago was $189,276,500. Statistics are not available to show the extent to which these gains may be reflected in net earnings.



Energy generated during December, 1938, rose 5.5 per cent over the November figure to 10,245,970,000 kw.-hr. and surpassed that of December, 1937, by 7.9 per cent. Of the total, 3,554,675,000 kw.-hr., or 34.6 per cent, was derived from water power, compared with 3,317,033,000 kw.-hr., or 34.9 per cent, a year ago.

Residential sales, 1,842,852,000 kw.-hr., were 8.0 per cent over the "domestic" a year ago. Commercial and industrial, 5,939,898,000 kw.-hr., overshot last year's combined commercial small and large light and power by 8.8%.

A strong upward movement in total sales has been in progress since May; the rise from 7,231,257,000 kw.-hr. in that month to 8,779,316,000 kw.-hr. in December is equivalent to 21.4 per cent.

Approve Bill to Aid TVA-Utility Purchase

Proposal of Senator Norris will enable agency to raise borrowing limit

Amendments to the TVA Act to give the authority the right to issue bonds for the purpose of purchasing existing generating plants of private utilities have been proposed in the move to raise the existing borrowing limit of TVA from $50,000,000 to $100,000,000.

The Senate agriculture committee this week approved and sent to the Senate the proposals of Senator Norris designed to enable TVA to purchase properties of Tennessee Electric Power Co. The committee expressed the opinion that the purchase price of $78,600,000 was $8,600,000 more than the property was worth, but said the difference could be "regarded as the cost of eliminating destructive competition, a competition damaging and injurious both to the TVA and to the private owners of the property involved."

In the report to the Senate the committee stated that the contemplated purchase would increase the revenue of TVA from power sales by about $5,000,000 a year, bringing the total to more than $11,000,000.

The proposed legislation would enable TVA to purchase a generating plant on a tributary of the Cumberland River, issue $100,000,000 of bonds and extend the bond issuing power from August, 1940, to January, 1941.

•

Plant Construction Set by Southern Utah Power

Hydro plant and transmission line reconstruction amounting to $100,000 has been announced by Reid H. Gardner, general manager of the Southern Utah Power Co., at Cedar City, Utah. Larger conductor will be installed on 30 miles of transmission lines and new poles and crossarms on 15 miles. A small hydro plant at Veyo will be completely rebuilt and voltage regulators and new circuit breakers installed at different points on the company's system.

•

Board Postpones Hearing

FPC has postponed to April 10 the hearing previously set for March 30 upon applications of 22 individuals to hold certain interlocking positions within the Engineers Public Service Co. system. The postponement was granted at the request of nine of those involved.

NEMA Members Plan Two-Day Conference

Arrangements for the two-day "open house" for executives of the electrical manufacturing industry to be held March 30 and 31 have been completed by the Department of Commerce.

The conference, to be held in Washington and sponsored by NEMA, is designed to acquaint the industry with the research and trade promotion facilities offered to business by the Department of Commerce. The industry ranks third in the amount of wages paid, fifth in the number of wage earners and eighth in the dollar volume of products among the industries covered in the Census of Manufactures.

The two-day conference will be addressed by Secretary Harry L. Hopkins on Thursday morning. He will be followed during the course of the two days by 26 officials of the Department of Commerce, who will detail their various activities.

•

Program Announced for Missouri Meet

The 33d annual state convention of the Missouri Association of Public Utilities will be held April 12-14 in Kansas City, Mo., at the Hotel Muehlebach.

All available past-presidents of the association will be seated at the head table as guests of honor at a get-together luncheon to be held in the Hotel President. The present president, Chester C. Smith, will preside.

Among the speakers will be C. W. Kellogg, President Edison Electric Institute. Some of the subjects will be: "Helping Ourselves," "What Is Before Us," "The Recovery Problem," "The Progress of Illumination," "Federal Competition and Its Effect," "The Man Who Sells" and "Advertising and Its Relation to Public Utilities."

D. W. Snyder, Jr., will preside at an open forum for the discussion of timely utility subjects. A safety meeting and round-table discussion of accident prevention will be in charge of A. A. Rall, Kansas City. Eight electric and gas companies have entered contestants in the statewide employees' speaking contest to be held on the evening of April 12. Cash prizes will be awarded.

•

Bonneville Contract Let

Bonneville administration has awarded a contract to Fritz Ziebarth Co., Long Beach, Calif., at $349,491 for construction of new transmission line for Bonneville project, extending from Columbia River crossing, near North Bonneville, to Ampere, Ore., where new power substation will be located. Work will comprise two 230-kv. single-circuit lines.

•

Rocky Mountain Groups Hold Sessions in Denver

This year's annual spring conferences of the accounting and engineering divisions of the Rocky Mountain Electrical League will be held on March 27 at the Denver Athletic Club and on March 28 at the Albany Hotel in Denver.

Topics that will be discussed in the engineering and operating meetings include: employee personnel problems, public relations, public liability and engineering and operation.

•

Utility Bonds Are Sold

A new issue of $17,500,000 first mortgage 3½ per cent bonds, due March 1, 1964, of Northern States Power Co. of Wisconsin was offered this week by Smith, Barney & Co. and Associates at 106 and accrued interest. The bonds were immediately bid to a premium. The company received 104 for the bonds.

MEETINGS

Association of Iron and Steel Engineers—Spring conference, Tutwiler Hotel, Birmingham, Ala., March 27–28. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Greater New York Safety Council—Annual convention, Hotel Pennsylvania, New York, N. Y., March 27–29. W. Dent Smith, Room 3615, Lincoln Bldg., New York.

Southeastern Electric Exchange—Annual conference, Ponce de Leon Hotel, St. Augustine, Fla., March 30–April 1. J. W. Talley, executive secretary, 308 Haas-Howell Bldg., Atlanta, Ga.

Oklahoma Utilities Association—Annual convention, Tulsa Hotel, Tulsa, Okla., April 3–4. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

Midwest Power Conference—Palmer House, Chicago, Ill., April 5–7. L. E. Grinter, dean Armour Institute of Technology, Chicago, Ill.

Missouri Valley Electric Association—Engineering conference, President Hotel, Kansas City, Mo., April 6–7. I. D. Pettegrew, acting director, 1527 Sharp Bldg., Lincoln, Neb.

Missouri Association of Public Utilities—Annual convention, Muehlebach Hotel, Kansas City, Mo., April 12–14. Jesse Blythe, assistant secretary. Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Maryland Utilities Association—Spring meeting, Lord Baltimore Hotel, Baltimore, Md., April 14. Warren D. Haley, secretary, 16 Carroll Ave., Takoma Park, Md.

American Institute of Electrical Engineers—Southwest district meeting, Houston, Tex., April 17–19. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

Northwest Electric Light and Power Association—Engineering and operation section, Seattle, Wash., April 19–22; accounting and business practice section, Vancouver, B. C., May 26–27. Berkeley Snow, secretary, 707 Spalding Bldg., Portland, Ore.

Electrochemical Society—Spring convention, Columbus, Ohio, April 26–29. Dr. Colin G. Fink, secretary, Columbia University, N. Y.

Northwest Engineers to Meet in Seattle

Engineers of the electric utilities, manufacturers and jobbers of the Pacific Northwest will convene at Seattle, Wash., April 19-22 at the annual meeting of the engineering and operation section of the Northwest Electric Light and Power Association. Headquarters are at the Olympic Hotel.

A. Vilstrup, B. C. Electric Railway Co., who is section chairman, has allotted a one-half day session to each of six committees who will present timely papers and discussions on subjects pertinent to their committee functions. Saturday, April 22, will be devoted to trips being arranged by J. Hellenthal, Puget Sound Power & Light Co., chairman of the local arrangements.

Committee chairman who will conduct their respective programs are: E. H. Collins, Washington Water Power Co., chairman of power production; J. Hellenthal, Puget Sound Power & Light, chairman of electrical equipment; R. J. Davidson, Pacific Power & Light Co., chairman of transmission and distribution; Walter Brenton, Portland General Electric Co., utilization; M. T. Crawford, Puget Sound Power & Light Co., chairman of codes committee; R. S. Maxwell, Puget Sound Power & Light Co., chairman of accident prevention committee.

•

Program Announced for S.E.E. Meeting

Southeastern Electric Exchange will hold its sixth annual conference at the Ponce de Leon Hotel, St. Augustine, Fla., March 30–April 1. The conference will be opened by Bryan C. Hanks, president of the Exchange and of the Florida Power & Light Co. W. E. Mitchell, vice-president and general manager, Georgia Power Co., will make the response to the addresses of welcome by Mayor Fraser of St. Augustine and Governor Cone of Florida.

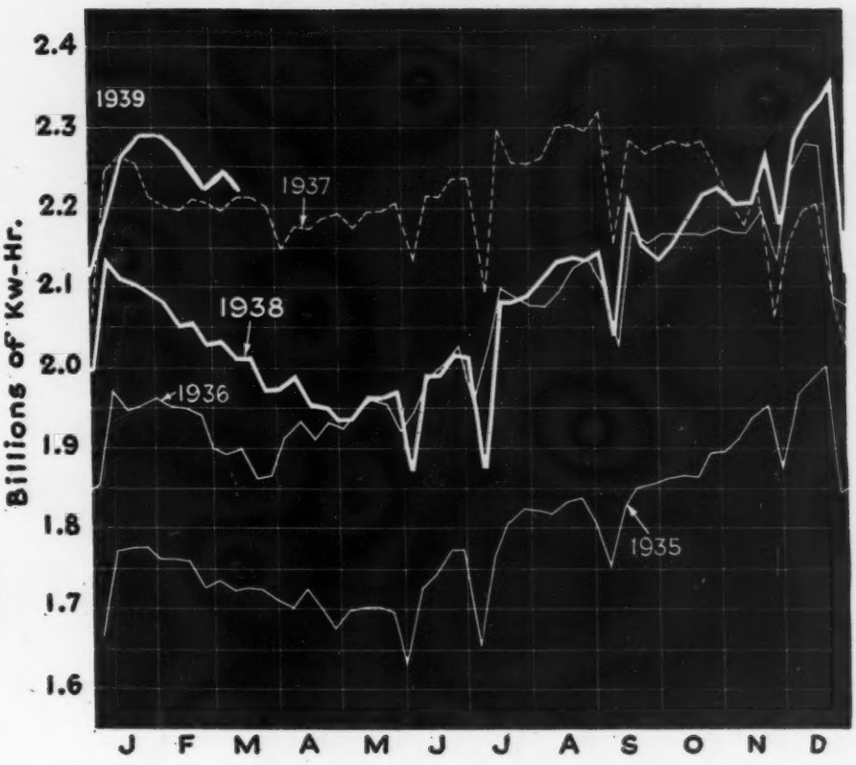
The program which has been arranged will include many subjects of vital importance to utility companies by authoritative speakers in and outside the industry. Owen D. Young, will speak on "What Is the National Program?" T. Justin Moore, vice-president, Virginia Electric & Power Co., will discuss "Labor Regulations of Interstate Utilities" and Jay Johns, chairman of board, Virginia Public Service Co., has taken for his topic "A Newcomer's Point of View." "Profitable System Load Building" will be analyzed by Major H. S. Bennion, E.E.I., and M. W. Smith, Westinghouse, will discuss "Power Transmission During National Emergency."

Output Dips in Week, But 10.3% Above 1938

Production of electricity by the electric light and power industry for the week ended March 18 was 2,225,486,000 kw.-hr., an increase of 10.3 per cent over the corresponding week of last year, according to the Edison Electric Institute.

While the output was lower than that for the previous week, 2,237,935,000 kw.-hr., the decrease was slight, amounting only to 0.58 per cent. The margin above the corresponding week of 1937 was 0.63 per cent, the lowest since the week ended January 14, in which this year's curve first rose above that for two years ago.

Reflecting the dip from the previous week, the major geographic regions almost duplicated their performances for the week ended March 4, with two exceptions. The West Central region increased its gain over 1938 to 7.0 per cent, while the Southern States section narrowed its comfortable lead to 6.2 per cent.



Weekly Output, Millions Kw.-Hr.

1939	1938	1937
Mar. 18...2,225	Mar. 19...2,018	Mar. 20...2,211
Mar. 11...2,238	Mar. 12...2,015	Mar. 13...2,213
Mar. 4...2,244	Mar. 5...2,036	Mar. 6...2,200
Feb. 25...2,226	Feb. 26...2,031	Feb. 27...2,207
Feb. 18...2,249	Feb. 19...2,059	Feb. 20...2,212
Feb. 11...2,268	Feb. 12...2,052	Feb. 13...2,200

Per Cent Change from Previous Year

Region	Week Ending Mar. 18	Mar. 11	Mar. 4
New England	+12.3	+13.1	+12.2
Middle Atlantic	+ 8.0	+ 9.2	+ 8.3
Central Industrial	+12.8	+13.8	+12.0
West Central	+ 7.0	+ 4.0	+ 5.4
Southern States	+ 6.2	+ 7.3	+10.5
Rocky Mountain	+ 9.3	+10.2	+ 8.7
Pacific	+ 9.4	+ 9.9	+ 9.3
United States	+10.3	+11.1	+10.2

Fogarty Sees Gains For North American

Extension of plants and systems of subsidiaries of North American Co. in the nine years from 1930 to 1938 inclusive totaled $235,000,000, of which approximately $200,000,000 was for electric facilities, James F. Fogarty, president, reveals in the company's annual report to stockholders.

Mr. Fogarty said that these plant additions were necessarily planned and construction begun from a year and a half to two years in advance, an anticipation of increased requirements for greater electric facilities. During 1938 the system spent approximately $20,200,000 in plant additions. The system now has an installed capacity of 2,019,360 kw.

It was pointed out by Mr. Fogarty that electric output for December and the fourth quarter of 1938 established a new record. The improvement in the last two months of the year has continued, with output in January and February showing an increase of 11 per cent over the same 1938 months.

Industrial power sales in 1938 were off 15 per cent, sales to residential and rural customers were up 7 per cent and sales to commercial customers showed a gain of 1 per cent over 1937.

At the end of 1938 North American subsidiaries were serving 1,054,133 residential and rural customers. The average annual use increased from 931 to 985 kw.-hr. and the average price decreased from 3.41 to 3.27 cents a kw.-hr.

In referring to the recent financing program and the elimination of North American Edison Co., Mr. Fogarty said that a saving of $850,000 annually was effected.

Operating revenues for the system totaled $116,572,101, against $121,347,366 in 1937. Net income after all expenses and charges was $15,109,007, against $18,502,481.

•

Utility Signs Contract for Casper-Alcova Power

Public Service Company of Colorado and the U. S. Bureau of Reclamation have signed a contract covering the delivery of 40,000,000 kw.-hr. of Casper-Alcova power annually into the Public Service system at Greeley, Colo., and Cheyenne, Wyo. The power is sold on a dump basis at a rate of 1.8 mills per kw.-hr., the approximate increment cost of coal at the Public Service steam plant at Valmont.

Delivery will be made over the new 205-mile, 110-kv. transmission line being constructed by the U.S.B.R. from the Casper-Alcova plant eastward into Nebraska, where a tie is to be made with the North Platte development.

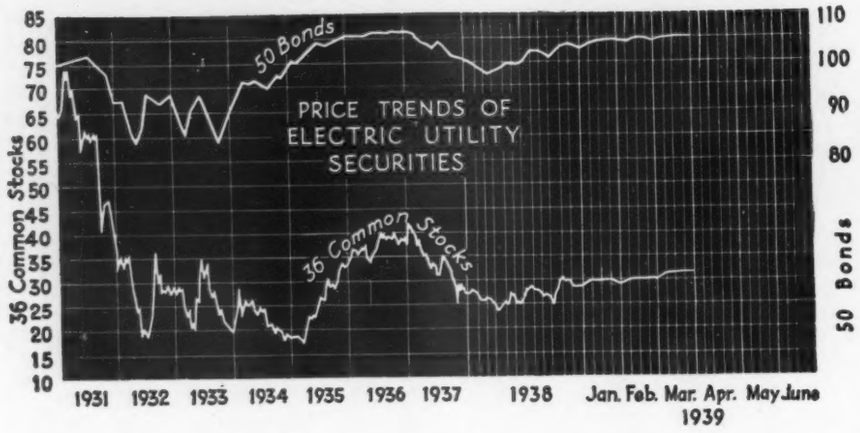
•

Injunction Suits Settled by Utility

Two injunction suits brought by Missouri Public Service Co., Warrensburg, Mo., seeking to prevent the cities of Pleasant Hill and Eldorado Springs from purchasing or acquiring municipal light plants were settled last week when the two towns agreed to purchase the electric light systems and "certain appurtenant properties" of the utility.

Settlement was made in the Circuit Court before Judge Thomas J. Seehorn, assignment judge. The utility agreed to bring no further contests of the validity of bonds voted last fall for the purpose of purchasing or constructing municipal light plants in those places.

Stocks and Bonds Drop in Week


50 Bonds
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
36 Common Stocks
36 Common Stocks
50 Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1931 1932 1933 1934 1935 1936 1937 1938 Jan. Feb. Mar. Apr. May June 1939

Electric utility securities closed somewhat higher on Tuesday last, although for the week they shared the downward movement of the general market, with the "Electrical World" stock index lower by 1.4 points to 30.8 and the bond index off 0.4 point to 104.8

Propose New Set-Up to Abitibi Holders

A new reorganization plan for Abitibi Power & Paper Co. has been forwarded to preferred-stock holders by a protective committee representing that group of stock. The plan involves the creation of a new company having $21,720,150 in new first mortgage twenty-year 5 per cent bonds, $48,267,000 general mortgage cumulative convertible twenty-year 5 per cent income bonds and 1,851,034 new common shares.

Each holder of a $1,000 bond would receive $450 in new first mortgage bonds and $1,000 in general mortgage bonds. Holders of the 7 per cent preferred would get ten new common shares for each share now held. Holders of the 6 per cent preferred would receive 4½ shares of new common for each share now held. Common-stock holders would get one new common share for each six now held. The general mortgage bonds would be convertible into common shares at the rate of ten for each $1,000 bond.

•

United Corp. to Buy Non-Utility Issues

SEC has announced that it has approved an investment program submitted to it by the United Corp., a registered holding company. The program calls for the investment over a period not to exceed six months of not more than $8,000,000 of its current funds in securities issued by non-utility companies.

United Corp. stated in its application that it proposes eventually to reduce its present holdings in the securities of the four utility subsidiaries, in which it holds more than 10 per cent, so as to cease to be a holding company under the Public Utility Holding Company Act. These companies are listed as Columbia Gas & Electric Corp., Niagara Hudson Power Corp., Public Service Corp. of New Jersey and United Gas Improvement Co.

The non-utility securities to be acquired are to be purchased for investment and not control, the company stated, and for the purpose of diversification of its portfolio, which hitherto has consisted of practically nothing but utility holding and operating company securities.

•

Files $25,851,900 Debenture Offering

Registration statement covering the issuance of not more than $25,851,900 additional convertible debentures, 3½ per cent series due in 1958, was filed by Commonwealth Edison Co. with the SEC on March 16 under the provisions of the Securities Act of 1933. A period of 20 days must elapse before the registration may become effective. Issuance of the debentures is also subject to the approval of Illinois Commerce Commission.

The debentures are proposed to be offered at par pro rata to Edison stockholders of record March 24, 1939. The exact amount of the new issue and of the subscription right that will attach to each Edison share cannot be determined until the record date. The subscription period will probably run from April 5 to April 28. The debentures will be of the same series as those now outstanding. Proceeds from the proposed issue will be used to retire all the bonds of Western United Gas & Electric Co. amounting to $25,800,000.

Upon the sale of the proposed additional debentures the authority originally granted by stockholders early in 1937 to issue not to exceed $130,000,000 will be substantially exhausted. Of the $104,148,100 heretofore issued, a total of $16,004,000 has been converted to date into Edison stock.

•

Cuts Dividend Rate On Preferred Stock

Stockholders of Nevada-California Electric Corp. voted this week at a special meeting to reduce the right of preferred stock to cumulative dividends of 3 per cent annually from 7 per cent, but provided rights to an additional 4 per cent a year in non-cumulative dividends after March 31.

Accrued unpaid dividends on the preferred stock after March 31 will equal $5.75 a share. This accumulation will not be affected by the action of stockholders this week. A. B. West, president, explained that the action was taken because present earnings do not justify continuance of cumulative dividend liability at the 7 per cent rate.

Later in the year stockholders will be asked to reduce the par value of common stock from $100 to $10 a share, creating a capital surplus of $7,729,470 to absorb certain write-offs.

•

Refunding Plea Approved

Provincial Electricity Board has approved the application of Montreal Light Heat & Power Consolidated for authorization to issue convertible note certificates in the amount of $20,000,000 for the purpose of refunding the company's 3 per cent debentures maturing July 1, next, of which there are outstanding a total amount of $21,696,300.

Utility Reports (Earnings)

	Net Income 1939	1938
*Arkansas Pwr. & Lt.	$1,277,058	$1,416,330
§*Associated G. & E. and subs.	35,234,293	34,631,461
‡The Detroit Edison and subs.	8,710,191	8,961,631
*Idaho Pwr.	1,682,148	1,559,541
*Louisiana Pwr. & Lt.	962,153	1,153,568
*Mississippi Pwr. & Lt.	628,485	696,059
*New Orleans Pub. Serv.	1,631,088	1,035,214
*The Washington Wat. Pwr. and subs.	2,530,805	2,694,823
	1938	1937
†The Niagara Falls Pwr. and subs.	3,028,788	4,167,696
†Philadelphia Elec. and subs.	21,652,707	22,751,248
†Southern Calif. Edison and subs.	11,733,479	12,136,162
†Standard G. & E. and subs.	1,383,421	4,342,524

‡Twelve months ended February 28.
*Twelve months ended January 31.
†Twelve months ended December 31.
§Operating income (preliminary).

PROTECT THOSE IMPORTANT TRANSMISSION LINES WITH G-E EXPULSION PROTECTOR TUBES

Operating Experience of Past Five Years Proves Their Dependability

Approximately 2000 miles of important transmission lines are now protected with G-E expulsion protector tubes. In a recent industry-committee survey, nine out of ten of the utilities reporting said that protector tubes had been completely successful. The tenth said, "Yes, so far, but haven't had sufficient operating experience."

Notwithstanding this successful record, G-E protector tubes have now been still further improved better to meet the operating requirements of transmission systems.

These G-E protector tubes can be supplied with complete mounting hardware for easy installation on practically any type of line structure. They can be applied to structures where no other type of protection could be economically employed. They require no costly grounding, such as low-footing resistances or counterpoises.

Now, before the lightning season approaches, why not investigate the application of G-E expulsion tubes to one of your important transmission lines? There can be no more convincing proof than your individual experience. Ask your G-E representative to give you a quotation, or write for Bulletin GEA-1858C. General Electric, Schenectady, New York.

GENERAL ELECTRIC

330-267

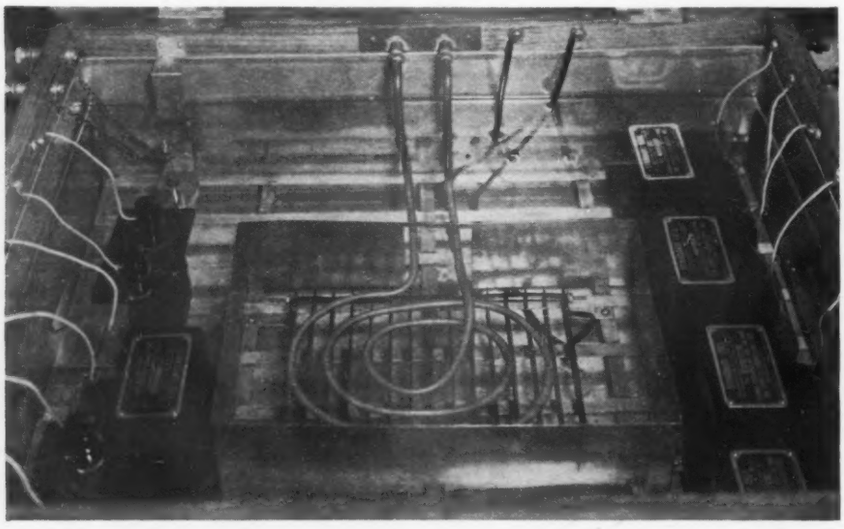
OPERATING PRACTICES

Constant Temperature Oil Bath for Cells

By RUSSELL G. GHEN
Boston Edison Laboratory, Boston, Mass.

For extreme accuracy, standard cells should be maintained at constant temperature. The actual value is not important and it may be anywhere between 50 and 100 deg. F. A convenient arrangement used by our laboratory was a wooden box 21x17x 10 in., lined with sheet copper and containing 10 gal. of oil and seven standard cells. A water white acid-free mineral oil is used and is tested every six months for acidity. When the acidity exceeds one-tenth of a milligram of potassium hydroxide per gram of oil it is replaced.

In order to maintain a constant temperature under all conditions, water-cooling coils and electric heating units are used. About 4 ft. of $\frac{1}{4}$-in. copper tubing connected to tap water through a small valve provides adequate cooling. The heating unit consists of fifteen 20-ohm resistance cards in series connected to a 115-volt circuit and controlled by a thermo-regulator. The heating and cooling units are located in the center of the bath surrounded by a baffle. A 1/20-hp. motor driving propellers at about 50 r.p.m. by means of a gear box assures uniform temperature throughout the tank. With this arrangement the temperature holds to within 1 deg. F. under all conditions of room temperature.



Bath for maintaining standard cells at constant temperature—Two small propellers in the hinged top (not shown) keep oil circulating

•

Water Spray System Protects Substation

Christiana substation of the Delaware Power & Light Company, recently enlarged* to meet the growing load, was, at the same time modernized to protect it against the hazards of fire and explosion. From other companies' experience, and certain experimental work, it was decided that the only sure method of protecting the transformers from fire was to install a fixed type of water spray system.

The Mulsifyre system installed supplied protection through a fixed dry pipe system on all three 25,000-kva. transformer banks. An electrically heated building contains a 9,000-gal. pressure tank, one compressor, valves and auxiliary equipment. The tank is supplied from the city water mains and automatically maintained under a compressed air head of 130 lb. The tank will supply water to two banks for three minutes with the pressure decreasing to 50 lb. If further drenching is required, city water is applied through the same system at 50 lb. pressure.

Each transformer bank has a separate dry discharge line from the tank house through a solenoid-operated deluge valve. An electric push button control is located in the operating room and the operator has a clear view of the substation yard in addition to the usual switchboard alarm signals. Supervising lights indicate the readiness of the system. Auxiliary manual controls are located in the switch yard and tank house.

In order to handle fires resulting from oil switch or instrument transformer failures large water mains with five fire hydrants have been extended throughout the yard. Fire hoses with Mulsifyre nozzles, mounted on racks which are inclosed in ventilated waterproof cabinets, have been installed adjacent to each hydrant.

Due to the fact that the water line had to be laid in a swamp, it was necessary that it should be strong, flexible and resistant to soil erosion. This was accomplished by using steel

* See also "Add Capacity, Reduce Hazards by Substation Redesign," ELECTRICAL WORLD, February 25, 1939.

Thinking of Improving Your *Lighting?*

G-E PYRANOL TRANSFORMERS AT LOAD CENTERS SAVED 40%

NOW you can modernize your lighting circuits—double and triple their capacity—*without installing new secondary copper.* This can mean *savings of up to 40 per cent.*

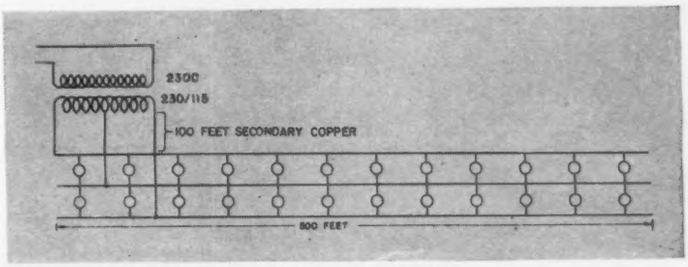
These savings are made possible by the use of Pyranol transformers, a G-E product which has been solving many other problems of power distribution in industrial plants. Because Pyranol, the liquid in these transformers, is noninflammable, they can be installed anywhere in the factory, even on beams up near the ceiling, without a fire-proof enclosing vault.

This means that you can divide existing lighting circuits into several sections, install a small Pyranol transformer at the center of each section, and modernize your lighting at much lower cost.

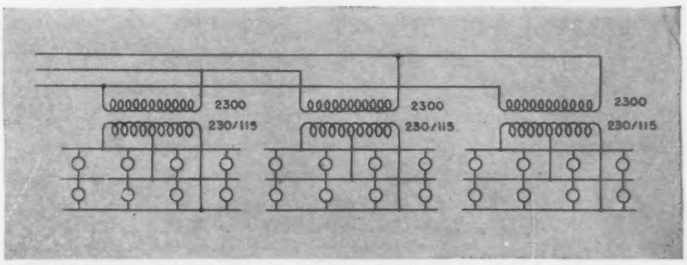
The diagrams on the right graphically depict the way this simple method was used in one industrial plant. Why not investigate it when relighting your next bay, floor, or building—and for new installations? We believe that the facts will lead you to specify Pyranol transformers. Ask your G-E representative for complete details, or write for Bulletin GEA-3180. Address General Electric, Dept. 6—201, Schenectady, New York

←

To obtain the maximum benefit from modern illumination standards, the level of voltage supply at the lamps should be maintained precisely. One of our new AIRS air-cooled regulators on the secondary of each circuit will free the lighting circuits from voltage fluctuations due to changes in power loads supplied from the same source. These regulators are described in publication GEA-3057



Old method—assume cost as 100%
Complete new secondary copper, with a new transformer in substation outside building

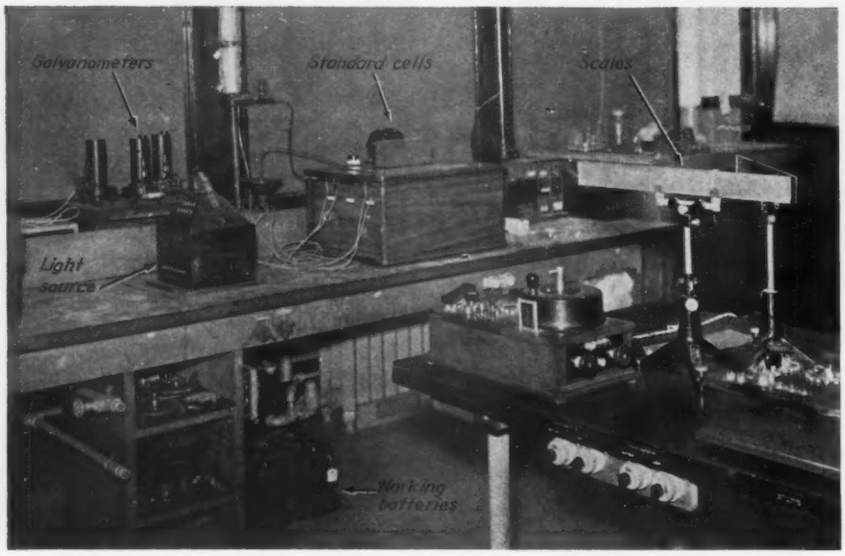


New, low-cost method—cost 60%
Use the existing secondary wiring, dividing it into several sections. Install a new primary feeder, and a small Pyranol transformer in the center of each section

GENERAL ELECTRIC

300-73

Vibration-Free Galvanometer Mounting



To minimize vibration and utilize space effectively in the Boston Edison Laboratory galvanometers are mounted on a brick pier, the light beam reflected across the aisle to the scale on the instrument testing bench. Working batteries, standard cells, and the light source are shown near the galvanometers. These are wired to the potentiometers through floor ducts

pipe, factory coated inside and outside, and connected with Dresser couplings. At the dead ends an extra length of pipe was laid to take care of silt and water hammer.

•

Study Transformer Noise Reduction

Reduction of noise from transformer substations can be achieved by three main methods, namely (1) reduction of flux density, (2) separation of the cooling equipment and sound insulation of the tank, and (3) reduction of the magneto-striction effect in transformer steels, according to an article in *The Engineer* (London). For reduction of 10 phon in the noise level, a decrease in flux density from 13,300 to 10,000 lines per square centimeter is essential. A slight increase in noise level due to the larger core necessary at the lower density partially offsets this gain, but the main disadvantage is the increased cost. The amount of noise reduction achievable by this method hardly justifies the increased investment, but may be of some help in a few cases. Tighter clamping of the core laminations also has little effect on decreasing noise in oil-filled transformers, although it is effective with air-cooled units.

Separating the cooling radiators from the transformer tank has been the most effective and economical method of reducing noise levels for transformers ranging from 200 kva. to 2,000 kva. in size. The separate radiators are connected to the main tank by flexible connections and the tank is then inclosed in a sound-proof box. Sound insulation for this purpose must be carefully selected as sound absorption coefficients of various materials fall off rapidly at low frequencies.

Screens around transformers have served to reduce noise close to the substation, but the reduction at a distance is much smaller, due to the diffusion of sound around the screen. In special instances, however, screens have proved effective, by breaking up multiple reflections from a wall. Use of grass-lined pits, cork bases and planting of shrubbery with transformers 10,000 kva. or larger, has also achieved a small amount of noise reduction, but sufficient in some cases to eliminate the complaints.

•

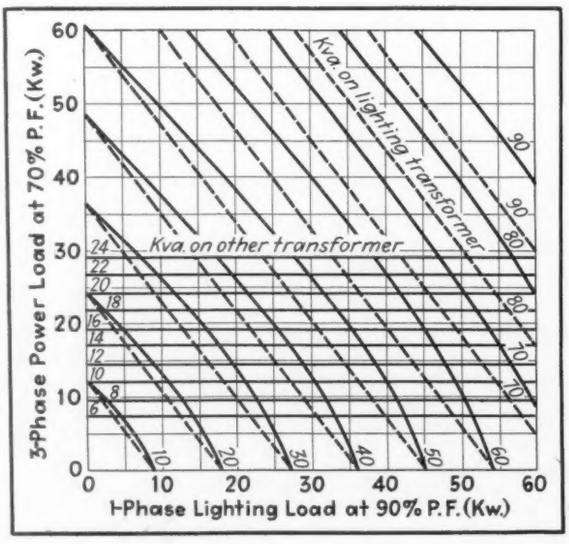
Unbalanced Load on Open Delta Banks

By BERTRAM E. ELLSWORTH
Electrical Engineer Iowa-Nebraska Light & Power Co., Lincoln, Neb.

It is common practice to serve a combination of light and power loads with open-delta transformer banks where the power loads are relatively small. The actual kva. loads on the transformers with such a connection depend upon the phase rotation and are not easily calculated.

The accompanying chart shows the kva. load on the two transformers with a given single-phase lighting load at 90 per cent power factor and a given three-phase power load at 70 per cent power factor. The load on the transformer serving only power is constant, regardless of the lighting load, and is shown by the horizontal lines.

The load on the transformer supplying both power and light is shown by the lines running at about 45 deg. with the vertical. The solid lines show the kva. load, if the lighting load is on the leading phase, with respect to the other smaller transformer. If the large or lighting transformer is on the lagging phase with respect to the small transformer it will carry more kva. load, which is shown by the broken lines. It will be observed that more load can be carried with a given transformer if the lighting load is placed on the leading phase.



Shows transformer loads on open delta banks serving mixed loads

As an example, a 50-kw. lighting and a 20-kw. power load are to be carried by an open-delta bank. These two values locate a point on the chart.

The position of this point between horizontal lines indicates that

Announcing

A NEW Lightweight Recorder Built Especially for Survey Work

INKLESS
For Indoor or Outdoor Use
Really Portable—Weighs Only 11 Pounds

NOW you can get a portable strip-chart recorder (voltmeter or ammeter) that is specially designed for survey work—General Electric's new Type CF-1. It's an inexpensive, small-sized, accurate recorder that offers these features:

It's Inkless—With no pen to clog and no ink to spill—or "paint" or evaporate or blur—a dependable, legible record can be made at all times. Furthermore, with the elimination of ink, you get successful operation in temperatures as low as −10F and as high as 120F.

It's Lightweight—Type CF-1 weighs only 11 pounds—less than half the weight of usual designs. It's easy to carry, easy to handle.

Portable—For Outdoor or Indoor Service—It's adaptable for wall or pole mounting, and a weatherproof case permits indoor or outdoor use. You can get as much as 30 days of continuous operation without attention—a real feature where frequent servicing is impractical.

Finally, these portables allow you to check circuit load conditions and to make voltage surveys that may lead to new savings. They're built for their jobs, and they're inexpensive.

Complete details of this newest G-E contribution to measurement savings—design features and sample records—are contained in Bulletin GEA-3187. For a copy, ask the nearest G-E office or write General Electric, Schenectady, New York.

SPECIAL Type CF-1 Temperature-compensated Voltmeter

To attain still higher accuracy over a wide temperature range, Type CF-1 voltmeters are available as single- and double-range instruments (rated 0-140 and 0-140/0-280 volts)—with temperature compensation for the 0-140 volt range.

DISTRIBUTION ENGINEERS—Here's What This Means To You

1. Greater precision in recording limits of voltage variation—in spite of adverse temperature conditions.

2. Dependable data with which to make profitable decisions regarding system changes.

3. Revenue protection—for in low temperatures, where uncompensated units would read high, the increased accuracy from temperature compensation works to protect profits; there's no chance for ill-advised lowering of regulator settings.

GENERAL ELECTRIC

430-140

there will be 16.5 kva. on the transformer serving power only. From the slanting lines the kva. load on the lighting transformer, if on the leading phase, will be 66 kva. and, if on the lagging phase with respect to the small transformer, will be 71.5 kva.

•

Chart Voltage Dip Due to Motor's Start

By E. M. ADKINS
Jersey Central Power & Light Company,
Asbury Park, N. J.

Even though the allowable limit and the procedure for the reduction of lighting voltage dip due to motor starting is known, it is necessary to know the magnitude of the voltage dip before curative measures can be applied. The accompanying three charts can be used in most cases to give rapid analysis of the dip in lighting voltage arising from this cause.

Where motors are fed from secondary circuits which also provide lighting service total dip in lighting voltage has two components: the voltage drop due to transformer impedance, and that due to secondary conductor impedance. These are found separately on the charts and added together, therefore the charts are used in two steps:

First step in using the chart is to find the portion of total voltage dip contributed by secondary circuit impedance. Starting in the third quadrant of the chart, with the distance in feet from motor to transformer on the distance scale, and reading in the direction of the arrows to an intersection with the line for motor size, thence to an intersection with the proper line for conductor size and from there to the voltage dip scale.

Second step is determination of the lighting voltage dip attributable to the transformer. This is found in the first quadrant of the chart by projecting to the voltage drop scale from the intersection of a vertical line representing the locked rotor current of the motor in question and the curves of transformer rating. Standard motor locked rotor currents are indicated in this quadrant. The proportion of the voltage drop arising in the transformer bank is to be noted. Use of a transformer having a low reactance will aid materially in the control of lighting voltage dips caused by low power factor motor starting.

Rated locked rotor current of standard general-purpose, squirrel-cage induction motors and impedance values of standard 120/240-volt secondary, single-phase distribution transformers given in the tables were used in constructing the charts. To simplify charting, all single-phase, 120-volt and 240-volt motors were considered to have a starting power factor of 40 per cent and all three-phase motors for use at 120/208 volts wye were considered to have a starting power factor of 45 per cent.

Transformer Data—2,400 to 120/240 Volts

Size	Full Low-Voltage Winding at 240 V. and Rated Load		One-Half Low-Voltage Winding at 120 V. and Rated Load of Half Winding	
	Resistance	Reactance	Resistance	Reactance
1.5 kva	3.44%	0.7 %	2.38%	0.521%
3	2.54	1.38	1.77	0.785
5	1.98	1.76	1.64	0.950
7.5	1.80	1.94	1.53	1.016
10	1.88	2.21	1.45	1.09
15	1.66	2.43	1.37	1.22
25	1.54	2.84		
37.5	1.384	3.15		

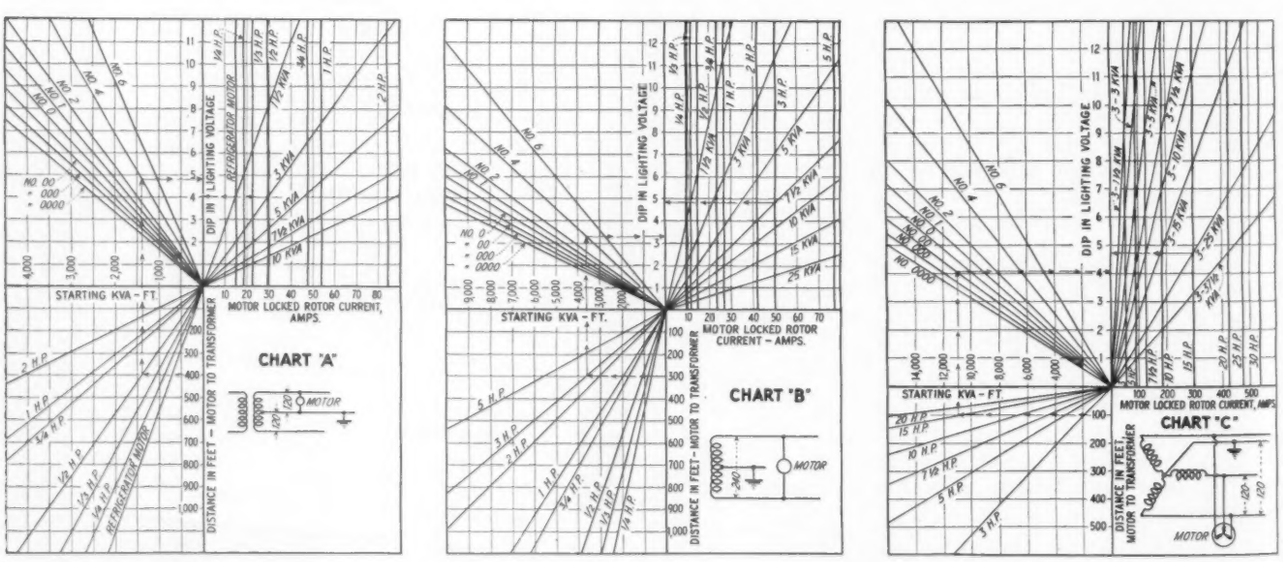
Single-Phase Motors, 120-240 Volts

Motor Size, HP.	Motor Rotor 120 V.	Locked Current 240 V.	% Starting Power Factor
*Refrigeration	15	....	40
¼	18.5	9.25	35
1/3	22.5	11.25	35
½	29	14.5	40
¾	47	23.5	45
1	54	27	45
2	84	42	40
3	..	50	45
5	..	77	40

Three-Phase Motors, 120-208 Volts

	120/208 V.	
3	53	45
5	91	45
7½	127	45
10	185	45
15	298	45
20	423	40
25	476	40
30	540	35

* 120 volts only.



Charts determine lighting voltage dip due to motor starting

Chart A, 120-volt motor starting on three-wire, 120/240-volt, single-phase secondary circuit; chart B, 240-volt motor starting on three-wire, 120/240-volt, single-phase secondary circuit; chart C, three-phase motor starting on 120/208-volt grounded wye circuit.

Use of chart A and chart C together permits determination of the lighting voltage dip due to starting of a 120-volt, single-phase motor connected phase to neutral on a 120/208-volt wye circuit. In this case conductor voltage drop is read from chart A and transformer voltage drop from chart C and the two readings totaled to give the full lighting voltage dip. Similarly it is possible by using charts B and C in combination to approximate the dip due to starting a single-phase motor, connected phase to phase on a three-phase, 120/208-volt wye circuit for 208-volt service. In this case the conductor voltage drop is read from chart C and the transformer voltage drop is read from chart C for twice the locked rotor current shown on chart B. The sum of the two voltage drops is then multiplied by 1.15, the ratio of 240 to 208 volts

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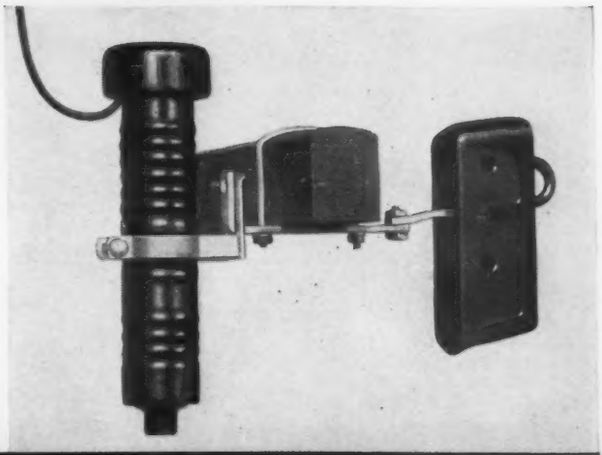
Thanks to G-E SPIRAKORE Transformers

THE G-E SPIRAKORE
construction has made an outstanding contribution toward greater economy in serving lightly loaded areas. Ask for Bulletin GEA-2421



For lower maintenance and a higher standard of service, protect each transformer with G-E lightning arresters and fuse cutouts. →

GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK

GENERAL ELECTRIC

INDUSTRIAL ENGINEERING

Graphic Meter Traces Trouble

By K. N. BANTHIN
Oak Park, Ill.

Benefit of careful instrument analysis of unusual plant phenomena is illustrated by the case of a Middle West rolling mill for white metal that was experiencing high rejection losses during certain periods of the day.

This plant had recently revised schedules in both sequence of operating units and personnel to meet increased demands for light-gauge (0.005 to 0.010 in.) sheets. A majority of this light-gauge material had to be finished on one specific machine. Of three crews, "A," "B" and "C," the "B" crew, working the shift from 3 to 11 p.m., had the most abnormal rejection due to "off gauge" and "waves." This was at first believed to be due to the fact that this crew was less experienced than the older "A" crew. However, with rotation of shifts even "A" crew's production on the 3 to 11 p.m. trick had a far too large rejection percentage. Meanwhile "B" crew, on another shift, was showing normal rejection.

Investigation into the operation of the equipment was made with a d.c. Esterline-Angus portable watt-hour meter in the feeder of the mill concerned and the illustrated charts were taken.

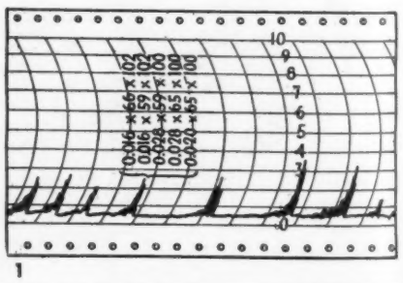
Study of chart 3 shows that the direct-current drive motor of the mill was actually acting as a generator for small portions of the time and causing variations in the speed of the rolls, with the resulting off gauge and waves in the sheet. It was found that the actual power required by the drive motor was about 100 hp. The motor was rated at 450 hp. and carried two 7-ton flywheels on the high-speed side of the gear reduction. Power for this mill and others was furnished by a single snychronous motor-generator set and under the revised schedule was found to be overloaded during the shift in which trouble was being experienced.

Upon an overload being placed on the motor-generator set the flywheels were converting their energy back into the line to carry the momentary overload and then overloading the line to try to bring them back to speed. Upon rescheduling of the operating units in a sequence that presented overloads of the power conversion equipment a uniform and normal production was maintained for the mill.

From Coal Bunker to Transformer Vault

One step in the expansion and modernization of the recently acquired Jersey City plant of Westinghouse Electric Elevator Company was redesign of the plant substation. In the process of rearrangement for provision of modernized electricity supply facilities abandoned coal bunkers were converted into a transformer vault, an engine room into a switch room and plant distribution voltage was changed from 220 to 440.

The elevator company formerly occupying this plant had once generated its own power, later changing to utility service using a 4,150/220-volt, three-phase outdoor substation. Construction of a new building to house equipment brought in (largely 440 volt) made a larger substation



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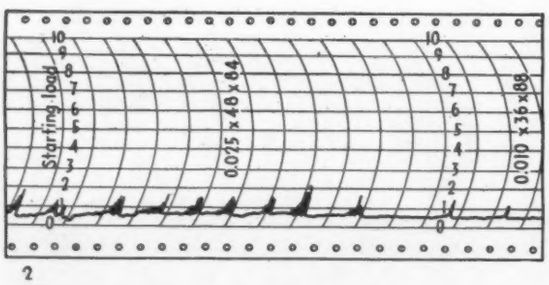

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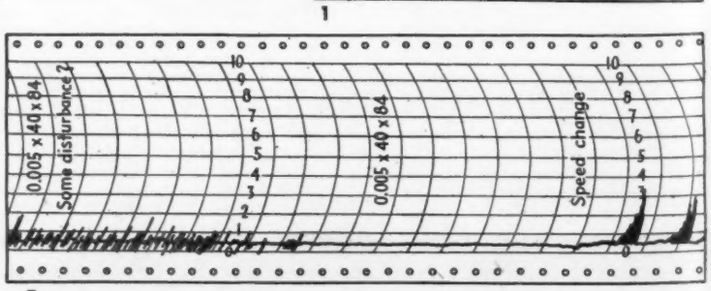

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Graphic watt-hour meter records disclose cause of off-gauge sheets from rolling mill

Chart 1 shows normal power requirements for breakdown of pack on heavy-gauge sheets (0.015, 0.016, 0.020, 0.028 in.). Chart 2 shows normal power requirements for breakdown of pack on light-gauge (0.010 in.) heavy-gauge (0.025 in.) and starting load of drive motor. Chart 3 shows normal power requirements for breakdown of packs on heavy gauge till 1 p.m., speed change before going to light gauge, normal power requirements for breakdown of packs on light gauge till 3 p.m. and further rolling of light gauge with disturbance and abnormal power conditions.

NO DISSIMILAR METALS IN CONTACT

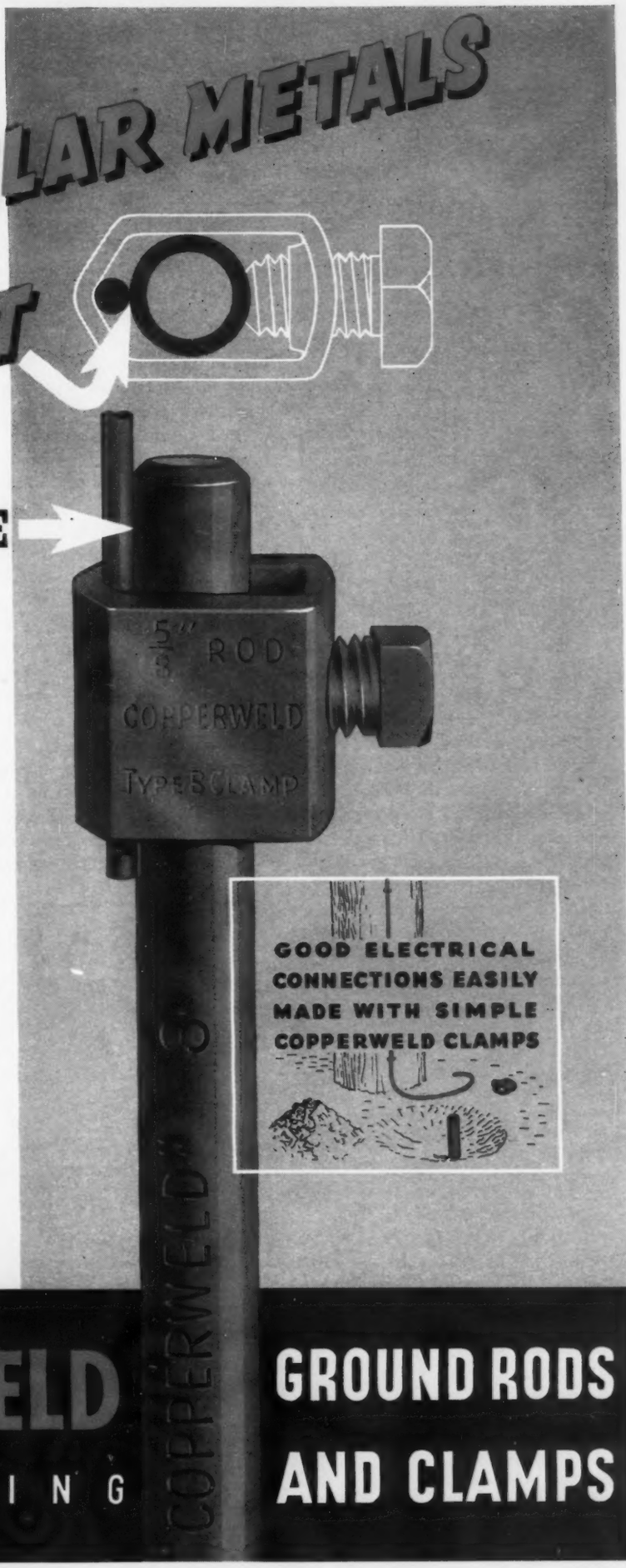
NO CORROSION HERE

A GOOD electrical connection between the ground rod and the grounding wire is essential for a reliable ground. Corrosion at this contact area can be caused by electrolytic action due to combining dissimilar metals in the presence of moisture.

When a copper ground wire is clamped to a Copperweld Ground Rod the contacts are copper to copper—there are no dissimilar metals in contact—and no electrolytic corrosion.

The economical method of protecting this vital contact area from electrolysis is to specify non-rusting Copperweld Ground Rods and Clamps thus assuring NO DISSIMILAR METALS IN CONTACT.

COPPERWELD STEEL COMPANY
GLASSPORT, PENNSYLVANIA



COPPERWELD
NON-RUSTING

GROUND RODS AND CLAMPS

Abandoned coal bunkers converted to transformer vault

necessary. In making plans for this new substation it was decided to bring it indoors, nearer the load center, and at the same time change the power distribution system to 440 volts to serve the imported machines.

Coal bunkers, abandoned when the original plant owners changed to purchased service, provided the only adequate space adjacent to both the load center and the distribution center in the old engine room. This was converted into a satisfactory 15x26½-ft. vault by construction of a brick partition and door across one end. Headroom in the vault, however, was at a premium.

To conserve headroom the three 200-kva., 4,150/440-volt wye-delta-connected power transformers have their primary bus carried on stubby inverted indoor insulators attached to the ceiling of the vault. The lighting and some of the residual 220-volt load in the old plant are supplied from two parallel banks of three 37½-kva., 4,150/220-volt transformers connected in wye to give three-phase, four-wire, 127/220-volt service.

Ventilation for the vault is provided by 30-in. intake and outlet ducts at diagonally opposite corners of the vault. Both ducts connect with the outside. The intake duct is brought in about 18 in. from the floor, while the exhaust duct is flush with the ceiling and discharges well above the roof.

The power engine room has been converted to a switch room by installation of metal-inclosed high- and low-tension switchgear.

Lighting Methods for Power Presses

In the case of power presses, as in other industrial applications which include close inspection in their operations, supplementary lighting is needed in addition to the general overhead lighting, points out a recent report of the industrial and school lighting committee of the Illuminating Engineering Society.

Whereas the overhead lighting serves to light up the area in front of the presses and also serves for stock and material handling processes, supplementary lighting is needed to build up the levels of illumination on the dies, which are inspected before and after the press operation. Layout of the plant and of the presses determines the overhead lighting layout, but in general, this sytem should provide not less than 10 ft.-candles as a sustained operating level at the working places.

The supplementary lighting of small and large power presses, which differ chiefly in the size of work produced and in speeds of production, is slightly different. For small presses it is recommended that the supplementary lighting be supplied from the back of the press whenever possible (for the operator's convenience), although front mounting may be used. In either case the lighting unit is attached directly to the press frame by a hanger so that the light will fall directly on the die surface.

For mounting behind the press, an angle-type reflector—circular, rectangular or elliptical—which has a relatively wide, smooth distribution is desired. This unit should have a maximum beam candlepower of 300 to 350, maintained over an angle of 70 deg. An operating minimum of 15 ft.-candles on the dies is recommended.

For the supplementary lighting of large power presses a satisfactory place to mount the units is on the corners of the presses, just above the die openings, being careful that they are so placed as not to interfere with the operator's movements. Number of units depends on size of presses.

For this application the recommended type of unit is the 100-watt concentrated industrial spotlight having a polished reflector and a clear or lightly stippled cover glass. The unit should project a beam of 1,500 to 2,000 cp. maximum, with a spread of from 30 to 40 deg. If a clear cover-glass is used louver rings should be added to prevent objectionable glare from reaching operators at adjacent corners of the press. Minimum foot-candle recommendations vary from 15 for forming, bending or shearing operations to 25 for die repairing.

Triple Lighting in Test Room

Test room of Packer Machine Company, Meriden, Conn.—At left, three RLM units with 150-watt daylight lamps yielded an intensity of 2 to 10 ft.-candles in a room 23 x 31 ft. with a 12-ft. ceiling. At the right there are ten Miller "No. RERD-200" units with 200-watt silver-bowl type lamps spaced on 10-ft. centers and 10 ft. 6 in. from the floor, which provide 20 ft.-candles.

TO MEET YOUR REQUIREMENTS

Rural-Line Transformers

Sub-Station Transformers

Wagner

Distribution Transformers Are Available In All Types and For Every Service

Such as:

STUD-BUSHING DISTRIBUTION
LEAD-TYPE DISTRIBUTION
RURAL-LINE
SURGE-PROTECTED
SUBWAY
SUB-STATION
AUXILIARY POWER
THREE-PHASE

In addition, Wagner builds distribution transformers to meet special conditions, a complete range of power transformers, general-purpose and air-cooled transformers.

High Voltage Stud-Bushing Conventional Transformers

Low Voltage Stud-Bushing Conventional Transformers

Surge-Protected Transformers

Subway Transformers

WHATEVER your needs may be, the Wagner line of distribution transformers is so extensive in sizes and types that it includes transformers that will fit your system's service requirements. . . . And they will do the job, too, for they are modern in construction and designed especially to conform to the latest standards. These modern Wagner transformers embody such features as: (1) carefully selected, pre-tested materials, (2) low electrical losses, (3) good regulation, (4) adequate safety features, and (5) details that make for ease of installation and maintenance. When making your plans for future line construction contact the nearest Wagner sales office. Wagner sales engineers will be glad to help solve your transformer problems. In the meantime, write for your copy of Wagner Distribution Transformer Bulletin No. 180.

Specify Wagner Transformers in Your Request for Quotation

T39-1

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, U.S.A.

Motors Transformers Fans Brakes

NEW ENGINEERING IDEAS

Wave Model Device Aids Lightning Study

A new mechanical device to illustrate traveling waves on a transmission line uses the mass of metal arms, the resilience of springs and the damping effect of a squirrel-cage motor to represent inductance, capacitance and resistance, respectively. Seen as a visual aid to the engineer in studying what happens when lightning strikes, or a short circuit occurs on a transmission line, the wave model can slow down a current surge from one ten-thousandths of a second to five or even ten seconds.

Each of the 56 elements of the device consists of a narrow aluminum arm mounted at its center of gravity on steel bearings. To each arm is rigidly mounted a flat spring, the free end of which is connected to the adjacent arm. Thus, when the first arm is moved up or down, the motion is transmitted successively to the other arms in the form of a wave, simulating wave transmission on a line with distributed constants. By letting the end arm move freely, an open line is typified; when the end arm is restrained, a shorted line is represented.

To introduce the effect of lumped resistances connected in shunt to the line, a damping element in the form of a squirrel-cage induction motor whose stator winding is direct-current excited is used. A system of strings around a wheel attached to the rotor transmits the motion to one of the arms. By varying the stator current the effect of different resistances is obtained.

Two of these damping elements are introduced to show the effect of low tower footings in reducing line voltages caused by lightning. The portion of the model to the left of the first element represents the lightning channel and that to the right the ground wire.

Lightning arresters are simulated by a projection which limits the travel of the particular arm, representing the location of the arrester.

The device was developed by C. F. Wagner, electrical engineer in the central station division of Westinghouse Electric & Manufacturing Company.

Mechanical device simulates traveling waves on transmission line

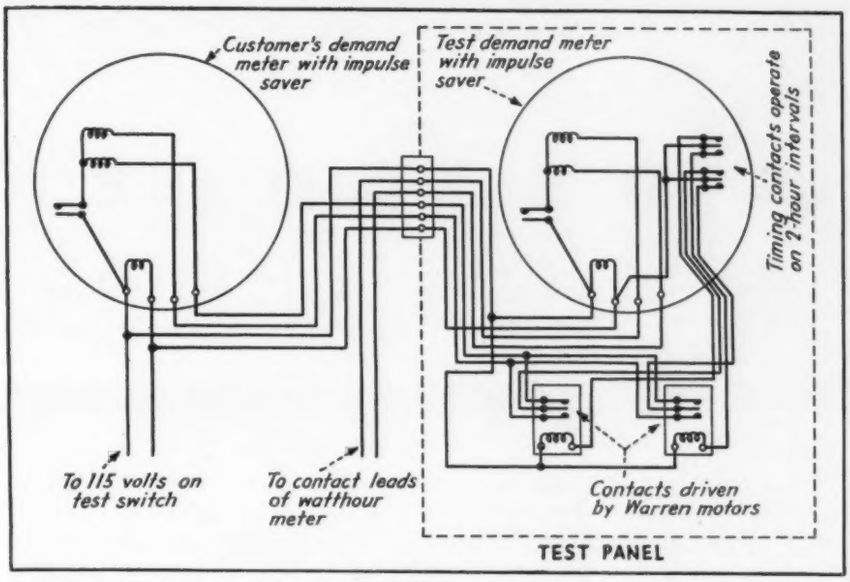
•

Checks Demand Meter on Premises

By WALTER C. WAGNER
General Superintendent Meter Division
Philadelphia Electric Company

A new method of testing impulse-operated recording demand meters in place on the customer's premises without loss of the customer's demand registration during the test period has been developed by the author with the assistance of his staff. Continuity of customer's demand during the test is preserved by placing the customer's chart on a special portable demand meter and placing a fresh test chart on the service demand meter. With this arrangement the calibration of the customer's demand meter under a definite number of contacts per demand interval—in this case a light and heavy demand alternately—is recorded on the test chart.

Since all of the internal operations of the instrument are permitted to function normally to effect the registration of a known demand, this method will detect errors resulting from slowing down of the motor


Customer's demand meter with impulse saver
Test demand meter with impulse saver
Timing contacts operate on 2-hour intervals
To 115 volts on test switch
To contact leads of watthour meter
Contacts driven by Warren motors
TEST PANEL

Portable test instrument verifies accuracy of demand meter on premises

drive, failure of the stylus to reset properly at the end of the demand intervals and errors existing in the action of integrator dials and in stylus travel.

The portable test device consists of two sets of constant-speed contacts, a test time switch to alternate the use of the contacts and a substitute graphic demand instrument to measure the customer's demand during the time his demand meter is out of circuit for test.

The constant-speed contacts are operated by cams rotated through gears by synchronous motors. These cams are one-point and six-point, producing 30 and 180 contact units per half hour, respectively. Three-wire contacts are used because of the two-coil operation of the "impulse-saving" demand instruments.* For demand meters not so equipped only a two-wire contact is necessary.

The test time switch feature is located within the portable demand meter case and consists of two sets of heavy contacts operated by large two-point cams mounted on the transverse shaft of the timing and chart-driving mechanism. This shaft rotates once in eight hours, which, with the two-point cams equidistantly spaced, gives equal intervals of operation of the 180 and 30 contact units of two hours each. Independent sets of contacts are required to energize selectively the motor and contact circuits, otherwise there are feed-backs and false operation of the device. The demand instrument which is substituted for the customer's demand meter is one equipped with an "impulse-saving" contact and time switch mechanism as stated above. The drawing shows the "impulse-saving" contact in both demand instruments.

Results of an extended series of field tests with this device also indicate a particular usefulness in cases where erratic operation may occur, yet would not be disclosed readily by any short-duration test.

•

New Control Tube for Industrial Use

Both grid control and magnetic control effects may be obtained from a new gas-filled electron tube, in which the strength of an externally applied magnetic field determines the value of anode voltage at which the tube begins to conduct. For each value of anode voltage there is a critical value of magnetic field intensity—in terms of m.m.f.—above which the discharge will not start.

Three different types of operation may be secured with the control tube:

1. For simple magnetic control the collector (a third electrode surrounding the discharge path) is directly connected to the cathode.
2. By varying the collector voltage an effect similar to that of grid control may be obtained. The difference is that the controlling effects of the collector potential and magnetic field are interrelated and may be additive or counteractive.
3. An industrial form of the tube may be operated with a discharge between collector and cathode, in which case ionization will be present in the tube without causing a discharge between anode and cathode. This type of operation adapts the tube—designed for high-voltage applications—to circuits where low anode voltages are used.

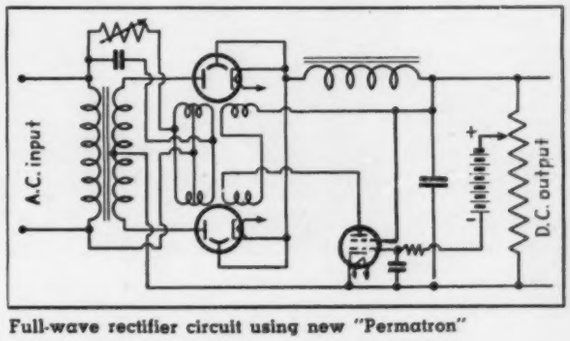
While the tube provides the same types of service obtained from ignitions and thyratrons, it has three characteristic features useful in certain types of applications:

(a) Control magnet and control circuit may remain electrically insulated from tube and its associated power circuit. This is useful in circuit arrangements—*e.g.*, welding control—which normally prevent the control of two or more tubes from a common control source.

(b) Polarity of magnetic field does not affect control of tube. Thus, in welding circuits, or full-wave rectifier circuits where the anode voltages are 180 deg. out of phase, voltage applied to the control magnets may have the same polarity or one magnet may be used to control both tubes. Again, due to the lack of reaction between the tube and control magnets, the tube may be operated directly from a transmission line without danger of reflection or from carefully balanced measuring circuits without danger to instruments. Since moving permanent magnets may be used to control the tube, combinations with moving machinery are seen as new possibilities.

(c) A third characteristic of the tube is its phase-shift control properties. Briefly, this means that the period when the tube is conducting may be varied by varying the phase relation between the m.m.f. and the anode voltage. As the amplitude of the m.m.f. is increased or decreased, the conducting period may be made shorter or longer, respectively. This is convenient in the case of resistance welding or motor control applications, where an accurate welding time or operating period is needed.

The tube, termed the "Permatron," is a development of the Raytheon Production Corporation, Newton, Mass. Tubes have been made with ratings ranging from an average anode current of 0.1 to 8 amp. and voltage to 3,500.



D.c. control magnet coils operated by amplifier tube controlled by variations in output voltage of rectifier. Phase-shift circuit of a.c. magnet coils adjusted to give maximum rate of change of output voltage for given change of current in d.c. coils and to set mean output voltage at value giving optimum performance of amplifier tube. Circuit designed to give constant output voltage regardless of input voltage or load variations

Full-wave rectifier circuit using new "Permatron"

* See ELECTRICAL WORLD, January 1, 1938, "Meter Improvement Increases Revenue."

LOAD BUILDING

10-Kw. Cleaning Vat Uses 400 Kw.-Hr.

For cleaning parts between machining operations the Cushman Chuck Company, Hartford, Conn., has recently installed four electrically heated vats which maintain a constant temperature of about 190 deg. F. with intermittent consumption of energy. A typical pot, made by Bauer & Company, Hartford, was equipped with heating units of 10 kw. rating to meet any future demands for service, but in actual practice this pot consumes but 400 kw.-hr. in 30 days. Service is supplied by the Hartford Electric Light Company, the pot being rated at 220 volts, single phase. Since the pot is insulated against material loss of heat and the solution kept below the boiling point, a tight fitting insulated cover can be used. No trouble from boiling over or discomfort and loss from the escape of heat into the room has been experienced. Service is available for cleaning 24 hours a day. Similar non-insulated pots have individually consumed 1,400 kw.-hr. per month. Control is superior to fuel-fired pots. Electric heat conserves energy in insulated equipment.

Electrically heated vats for cleaning parts use from 400 to 1,400 kw.-hr. per month

•

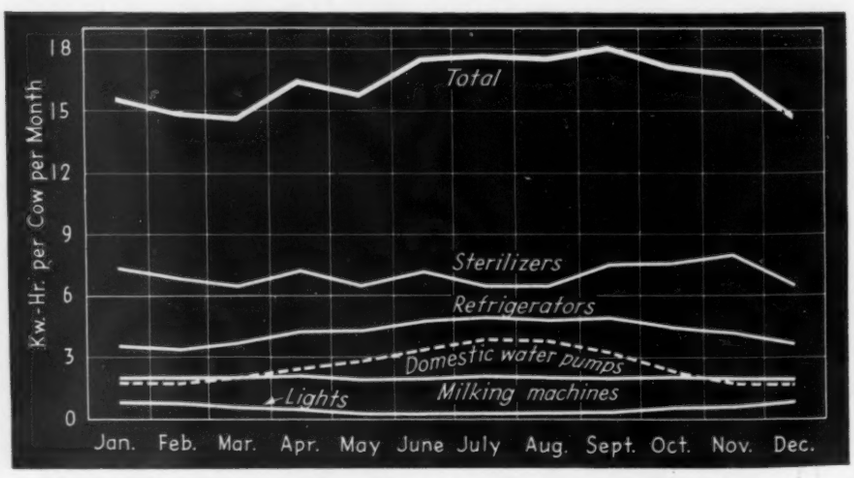
New Load Data on 30 Dairy Farms

By J. R. TAVERNETTI
Division of Agricultural Engineering, University of California, Davis, Calif.

As a gage of the potential market for electrification and as an aid in providing the rural power salesmen with average figures for use in selling various electrical applications, a survey of 30 dairy farms conducted by the California Committee on the Relation of Electricity to Agriculture reveals some interesting data. Purpose of the survey, which extended over two years, was to determine the energy consumption on electrically equipped dairy farms for each of the different electrical applications.

Thirty dairies were selected, varying in size from 30 to 150 cows. Not all of the farms were completely electrified, but data were secured by submetering consumption on fifteen refrigerating units, thirteen milking machines, nine domestic pumps, nine electric sterilizers and four sets of dairy lights. Meter readings for each individual application were taken monthly and at the conclusion of the study were compiled to show monthly and yearly averages on the basis of kilawatt hours per cow. The figures for all of the dairies are shown on the accompanying curve.

From them it can be determined that average consumption for lighting is 0.5 kw.-hr. per cow per month; milking machines, 2 kw.-hr.; domestic water pumps 3 kw.-hr.; refrigeration, 5 kw.-hr; dairy sterilizer, 7 kw.-hr., or a total of 17.5 kw.-hr. per



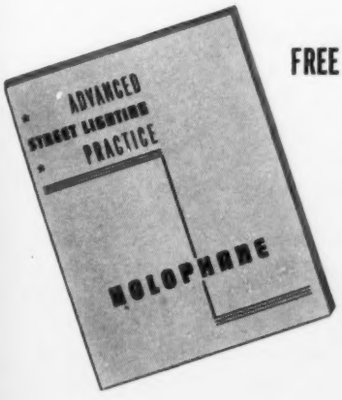
Average monthly energy consumption per cow for various types of electrical applications based upon a survey of thirty dairy farms located in California

Why Leading Utilities use Holophane Refractors for Street Lighting

1. Holophane refractors put more light on the street or highway because upward light is bent downward and shaped to the road contours.

2. This increased illumination provides greater safety because better visibility reduces accidents and facilitates police and fire protection.

3. Utilities have proved that this civic improvement is obtained *at no added* expense because Holophane refractors reduce breakage and labor charges in maintenance and replacements.



FREE *to Street Lighting Engineers*

Send for your free copy of "Advanced Street Lighting Practice." It is an essential guide to the utility engineer charged with the responsibility of providing street lighting service. The book contains information on the fundamentals and trends in street lighting practice as well as complete data on refractors to meet all types of street lighting problems. Address your request to:

HOLOPHANE

STREET LIGHTING DEPARTMENT

Newark, Ohio

In Canada: Holophane Co., Ltd., 385 Yonge St., Toronto, Canada

Holophane refractors are recommended and supplied by the leading manufacturers of street lighting equipment.

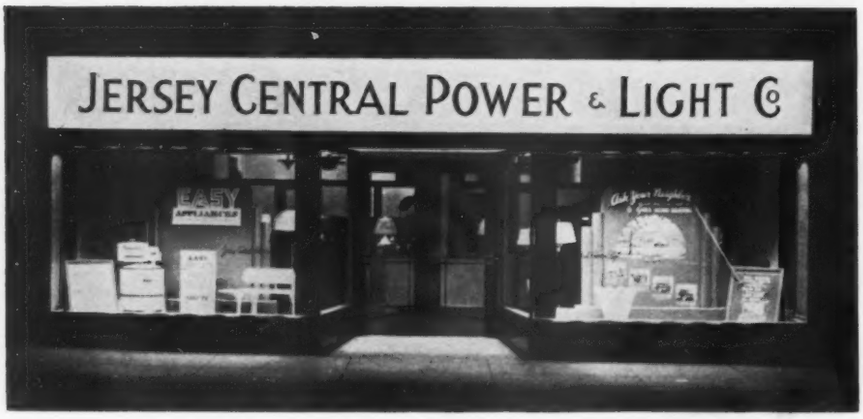
RESIDENTIAL STREETS—Syracuse, N. Y. The Central New York Power Company installed Holophane refractors in the residential areas, to bend light out toward the street—away from the building line, and up-and-down the roadway.

BUSINESS DISTRICTS—Hartford, Conn. The Hartford Electric Light Company uses Holophane refractors designed to produce illumination intensity and light distribution for "discernment of object details."

ARTERIAL THOROUGHFARES—Whitehorse Pike, N. J. The New Jersey Utilities provide Holophane refractors designed to bend the light downward, and direct it up-and-down the roadway in two powerful beams. High roadway brightness, with reduced glare is obtained by high pedestals.

BRIDGES, BRIDGE-APPROACHES, ETC. — Once-hazardous sections are rendered as safe by night as by day through the use of Holophane refractors provided by the Louisville Gas & Electric Company. Light is directed to the roadway itself with minimum waste on unimportant areas.

Modern Front for Modern Offices



Green letters of copper bolted to a lighted background panel of warm tan Vitrolux combine to make this an effective and striking treatment for the front of the newly remodeled offices of the Jersey Central Power & Light Company at Boonton, N. J.

The panel, 33 ft. long and 3 ft. high, is lighted from the rear by two rows of seventeen 100-watt lamps arranged on 18 in. centers in a wooden "light box" extending back 18 in. from the panel surface. The box is painted with two coats of flat white on the inside. Unlighted tan Vitrolite surrounds the lighted panel, a green bulkhead of Vitrolite runs under the windows."

cow per month. Use varies slightly from month to month, more refrigeration for milk cooling and more water being required during the summer months.

These figures not only provide a gage of the potential load available from dairy electrification sales activities but also permit the rural sales engineer to quote average use figures.

•

Four-Month Campaign Sells 150 Coolers

Five carloads of electrically driven milk coolers, totalling 150 machines and insulated boxes, were recently sold by the Public Service Company of New Hampshire in a special drive lasting about four months. The units were purchased from the Kelvinator Corporation on a price basis which enabled the company to realize a satisfactory profit in marketing each unit at $199.95 cash, time payments ($10 down and 36 months) also being accepted with allowance for carrying charges. Each unit contains a refrigerating machine driven by a ¼-hp. motor and a box holding four 10-gal. cans. The cooler is of the dry type and consumes from 60 to 75 kw.-hr. per month on the average. Temperatures are automatically maintained at about 35 deg. F.

The coolers were sold all over the system after being distributed from Manchester headquarters. The sales force of 45 participated, and in general the market was built up on the basis of demonstrations at various farms, the equipment being mounted on a company truck and plugged into the nearest convenient outlet. In some cases immediate sale was made and installation followed at once. The basis of selling was emphasis upon the higher price obtainable by the dairyman for milk of low bacteria count as received in the city markets, the availability of a cooler of this moderate size at approximately $200 also having strong pulling power. Units of this size and price appeal to many farmers in the company's territory, even as larger outfits appeal to larger producers.

Chester Andrews of N. H. Public Service demonstrates moderate-priced milk cooler in campaign which sold five carloads

•

"Blue Book" Used for Range Trade-ins

A used-range "blue book" setting up maximum trade-in allowances for various models of electric ranges has been established by the California-Oregon Power Company for use by both company and local dealers as a guide in pricing allowances.

The book capitalizes on experience in the used-car field, but especially was needed because most dealers are not equipped to modernize old equipment and cannot afford to handle ranges traded in on new models.

The new plan provides that the company shall buy all used electric ranges from the dealers at the blue-book price less 20 per cent. The ranges are then rebuilt and resold as used merchandise.

Every one benefits—the dealer secures an immediate market for used equipment and he does not tie up his profit; the company can more easily encourage the dealer to help maintain modern and satisfactory load sources, and can, furthermore, maintain a steady supply of equipment which can be rebuilt and sold to people of low incomes.

And according to Glenn Jackson, Copco's vice-president in charge of sales, the company benefits in yet another way: "While it is true that many ranges taken in are of such age and condition as to be unsatisfactory for modernization or resale," he says, "the company is better off in removing this equipment from use. Because without such removal operating results and maintenance cost are unsatisfactory from both the customer and the company viewpoint."

Simplex — ANHYDREX AA-LL

= Long Life
Heat Resistance
Best Electrical Prop.
Lowest Water Absorption

Simplex-ANHYDREX AA-LL is the answer to the engineer who is looking for an insulation that really "has something on the ball." Simplex-ANHYDREX AA-LL combines for **the first time** in one rubber insulation all the desirable properties a good insulation should have. It has long life. It has high heat resistance. It has the best electrical properties together with the lowest water absorption obtainable in any rubber insulation.

1. Laboratory tests indicate that the normal life of Simplex-ANHYDREX AA-LL is 4 to 5 times that of ordinary rubber compounds when exposed to the same conditions.
2. Simplex-ANHYDREX AA-LL can operate continuously in temperatures that would destroy ordinary rubber compounds.
3. Simplex-ANHYDREX AA-LL has low unit capacitance, low power factor, high dielectric strength and high insulation resistance.
4. Simplex-ANHYDREX AA-LL retains the low water absorption characteristics of Simplex-ANHYDREX that to date have been unsurpassed and which have made ANHYDREX famous wherever a rubber insulation must come in contact with water or moisture.

Simplex-ANHYDREX AA-LL is the most radical and the most far reaching development in rubber insulations since Simplex-ANHYDREX was placed on the market in 1932. Data Sheet No. 112 which contains adequate test data will be sent on request.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex-ANHYDREX

deproteinized rubber insulation for wires and cables

NEW EQUIPMENT

Pyrometer Controller

A new damped photo-electric circuit has been developed for this indicating pyrometer controller so that the unit will not respond to abnormal disturbance of

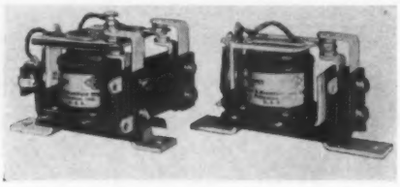
"Celectray" Model "V"; in temperature ranges varying from minus 50 to plus 3,000 deg. F.; for use on 110 or 220 volts, 25, 50 or 60 cycles, a.c. only; 15-in. scale. **C. J. Tagliabue Mfg. Co.**, Brooklyn, N. Y.

the light beam. The controller makes use of photo-electric deflection of the position of a light-beam reflected from the mirror of a moving galvanometer to obtain high sensitivity and practically instantaneous response. Although sensitive to temperature changes, the instruments are said to be vibration-proof and can be mounted rigidly in a vibrating panel along with the control device (such as a magnetic contactor) or next to a drop hammer without regard for the possible effect of vibration.

•

Midget Relays

These midget relays are offered for those applications where a small relay is needed, single-pole models being 2⅞ in. long, 1⅜ in. wide by 1⅝ in. high with double-pole types slightly larger. Contacts of the single-pole models carry ratings of 8 amp. non-inductive 110 volts a.c., ¼ hp. motor loads 110 volts a.c., 3 amp. non-inductive 110 volts d.c. and the double-pole models ratings of 6 amp. non-inductive or 1/6 hp. motor loads on 110 volt a.c. and 2 amp. non-inductive 110 volts d.c. Both a.c. and d.c. coils are offered for voltages to 220 on a.c. and 110 on d.c.

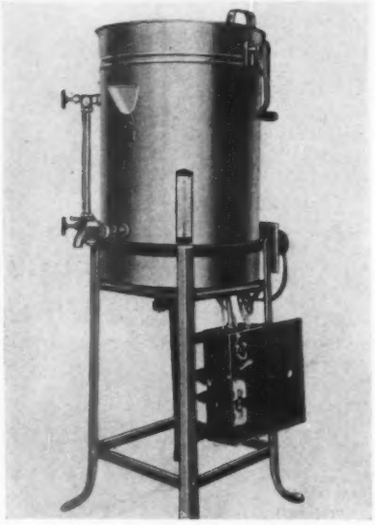


Midget relays; single- and double-pole in single- and double-throw styles. **Potter & Brumfield Mfg. Co.**, Princeton, Ind.

•

Electric Glue Kettle

Electric immersion heating units are used in these electric glue kettles which also use a thermostat to keep the glue at a fixed temperature. Relay, cut out and switches are separately mounted on the stand. A hand or mechanical agitator is part of the equipment; a water gage and thermometer and a quick-acting draw-off valve for the glue are other features.



Electric glue kettle; capacities range from 10 to 50 gal., with ratings from 4 to 14 kw. **Acme Electric Heating Co.**, Boston, Mass.

•

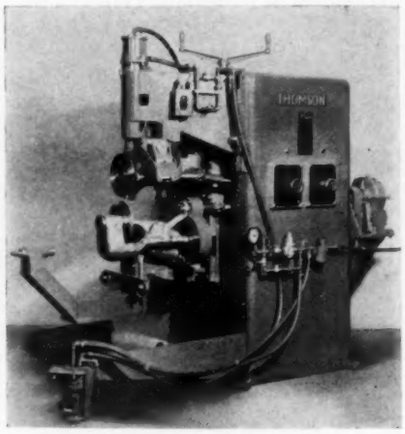
Frequency Meters

Type "FA" 4-in. square a.c. frequency meters; 55-65 cycles, voltage ranges from 100 to 250. **Roller-Smith Co., Bethlehem, Pa.**

To its line of 4-in. instruments, this company has added a 4-in. square a.c. frequency meter. An electromagnet mechanism is used; the instrument has a stated accuracy of ¼ of one cycle.

Seam Welder

This seam welder for cylindrical work is equipped with a special lower arm and work-holding fixture which are mounted on a column and can be swung to one



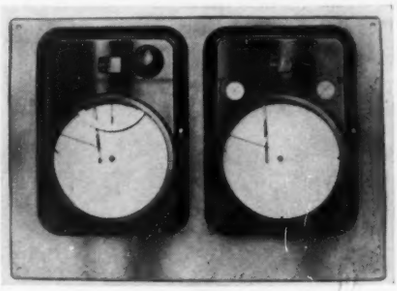
Model "1020," 200-kva., double-knurl driven circular seam welder. **Thomson-Gibb Electric Welding Co.**, Lynn, Mass.

side to facilitate loading and unloading. Sixteen-point heat regulation, air control by foot-operated valve, variable welding pressure up to 1,400 lb., and welding speeds from 5 to 15 ft. a minute are other characteristics.

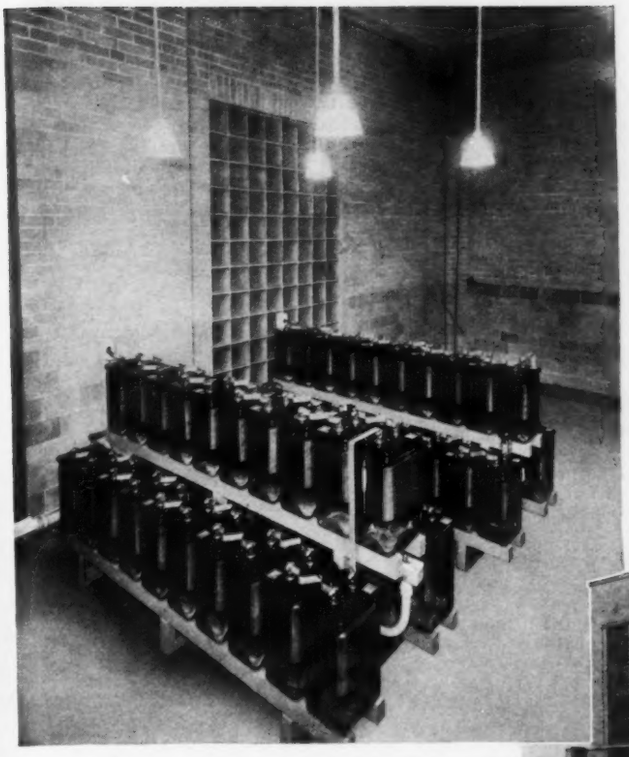
•

Flow Ratio Control

A flow recorder and a flow recorder controller are combined to give a device which allows the rate of flow of one fluid to be maintained in a definite ratio to the flow of a second fluid. The rate of flow is measured and recorded by one instrument, which also sets the control point on the



Flow Ratio Controller. **The Bristol Co.**, Waterbury, Conn.



Sixty-cell Exide-Chloride Battery installed in the Carondelet substation of the Union Electric Company of Missouri (at right), for control bus operation and emergency lighting.

Again it's

Exide

CHLORIDE BATTERIES

—chosen this time, by the Union Electric Company of Missouri for its new Carondelet substation.

Section of an Exide-Chloride Battery's positive plate, showing "rosettes" or "buttons" of corrugated lead securely anchored in alloy grid.

Rosette of pure corrugated lead, partially uncoiled to show its construction.

TYPICAL of the most modern engineering practice in distribution substation design, is the Carondelet substation of the Union Electric Company of Missouri.

Built to meet the increasing load conditions in the extreme southern part of St. Louis and its suburbs, this attractive, two-story structure of brick and glass building blocks, contains only the finest and most modern equipment known to the engineering profession. Two 10,000 to 13,333-kva., 33,000/4500-volt, 60-cycle, three-phase transformers and five 500 amp., 4500-volt, three-phase regulated outgoing feeders, constitute the present, initial installation. Space has been provided however for one additional transformer and six more outgoing feeders.

As is the case in so many other modern power plants and substations where quality of equipment is of paramount importance, the Carondelet substation depends upon a 60-cell Exide-Chloride Battery for control bus operation and emergency lighting.

The Exide-Chloride is held, almost universally, in the highest regard by engineers all over the world. In any stationary service, its dependability, long life and comparative freedom from maintenance, is traditional. We strongly recommend it to anyone desiring an exceptional battery for stationary service. Bulletin 204 describes it completely; write for your copy.

THE ELECTRIC STORAGE BATTERY COMPANY

The World's Largest Manufacturers of Storage Batteries for Every Purpose

PHILADELPHIA

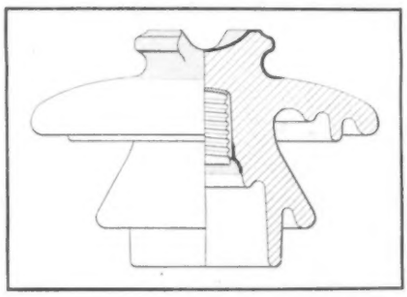
Exide Batteries of Canada, Limited, Toronto

second. The latter then records and controls the flow proportionately to the first, depending on the ratio selected. The ratio may be changed by turning a knob on the outside of the case. Maintaining a 5 to 1 ratio between the flow of air and fuel gas might be one application of the instruments.

•

"Quiet-Type" Insulators

For the elimination of radio noise interference, these insulators use a combination of metallic oxides which is applied to certain critical areas prior to the glazing of the clay body. In this way a thin film of



"Q-T" insulators; "Mono"-type pin-type shown; switch or bus, and suspension-strain types also offered for various voltages. **R. Thomas & Sons Co.**, Lisbon, Ohio.

metallic oxides is ceramically bonded to both the porcelain area and the glaze and acts to damp out radio noise effects through the resistance of the metallic coating. By reducing the electrostatic flux density at the critical areas corona is reduced or eliminated, removing the cause of radio interference.

•

Roller-Actuated Switch

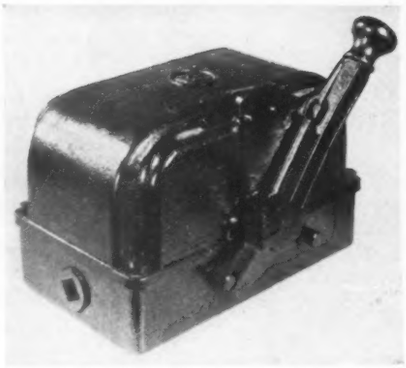
Designed for those applications where small moving power is needed to make or break circuits, this switch is actuated by a roller leaf spring and might be used to control motors, heaters, solenoids and the like from cams, slides or rolls.

Roller leaf actuated "Micro" switch; handles ½ hp.; 2½ in. long, 1⅜ in. high and ¾ in. wide; single-pole, single- or double-throw. **Micro Switch Corp.**, Freeport, Ill.

•

Industrial Controls

A new type of master switch for a.c. or d.c. mill and crane controllers and a new series of field rheostats for adjusting speed of motors in such industrial services as steel and paper mills have been announced. On the switches, a cam-opened, spring-closed arrangement is used to prevent contacts from remaining closed on a point when they should be open. Shallow base and deep cover make for ease of inspection and wiring and the switches may be group mounted, vertically or horizontally. Rheostats consist of face-plate with contact arm and tube-type resistors assembled as



Type "SM-25" five-point master switch; Type "JM" mill-type field rheostats not shown. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

a unit in a frame. Face-plate provides 60-point speed control. Individual resistor tubes may be removed and replaced.

•

Range Unit

This new range unit is designed to give five different heats when used with a five-heat switch and connected to a three-wire service. On "high" switch position, all three rings are energized for a total rat-

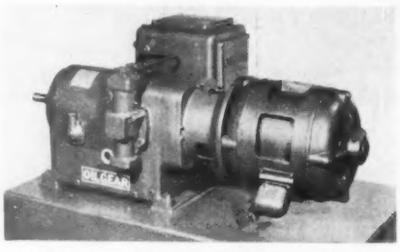
"Chromalox Super-Speed" 3-ring, 2,000-watt, 230-volt range unit. **Edwin L. Wiegand Co.**, Pittsburgh, Pa.

ing of 2,000 watts. "Medium" gives 1,400 watts on the outer and inner rings; "Center" gives 600 watts on the middle ring; "Low" gives 350 watts on the outer and inner rings and "simmer" gives 125 watts distributed over the entire unit.

•

Variable Speed Drive

Designed to give precisely the desired speed regardless of changes in load, voltage, frequency, speed of drive, oil temperature or running fits, this unit comprises the company's standard fluid power transmission with micro servo-motor stroke control cylinder to adjust pump stroke to



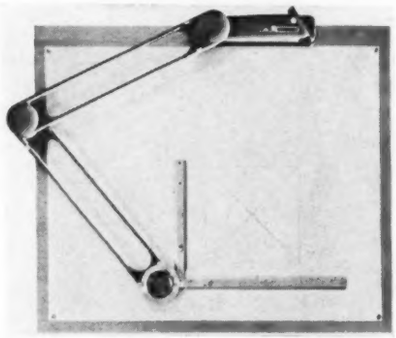
Precision variable speed drive; applicable to company's line of fluid power pumps, motors and variable speed transmissions. **The Oilgear Co.**, Milwaukee, Wis.

give the required hydraulic motor speed. Oil is admitted to this cylinder by a pilot valve, actuated by a differential unit which compares the speed of the motor with time or with the speed of any desired master unit. Each unit drive may be controlled directly by time to give absolute speed in r.p.m. or by any master unit or roll stand to give a speed ratio with another unit. Units may be driven by induction motor or from line shaft.

•

Drafting Machine

Bands and working parts of this drafting machine are completely enclosed as a protection against accumulation of dirt between the bands and wheels. To the full-



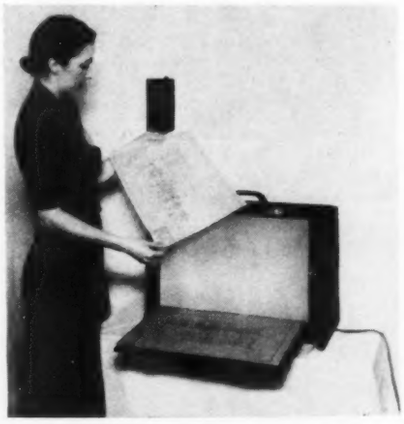
Model "77" drafting machine. **Universal Drafting Machine Co.**, Cleveland, Ohio.

vision protractor, located entirely above the arm for greater vision and convenience of operation and control, a secondary 360 deg. protractor movement has been added, to make possible the setting of the protractor to any angle on the drawing, such as 7 or 77 deg. Then from the new base-line, the 30-, 45-, 60- and 90-deg. stops can be used or any graduation read directly.

•

Portable Printer

New portable printing machine uses "Ozalid" dry process paper. The printing paper is placed on the inside of the door



"Elpro" printer; operates on 110 volts, a.c. or d.c.; uses blue-, black- or red-line paper. **Electronic Products Mfg. Corp.**, 208 West Washington St., Ann Arbor, Mich.

and the tracing laid directly on it. Closing the door turns on the light source—six lamps totaling 850 watts—which is left on for about 1½ minutes. The exposed print is removed and placed in the developing cylinder which has an ammonia container at the bottom. After two or three minutes, the print is removed and is ready for use.

PURCHASED
1934
December

TESTED
1936
May 26
July 22
Oct. 19
Dec. 28

TESTED
1937
Feb. 23
Apr. 19
June 25
Sept. 22
Nov. 16

TESTED
1938
Jan. 17
Mar. 16
Apr. 12
May 17
June 24
July 22
Sept. 20
Nov. 30

TESTED
1939
Jan. 27

Mar. 14
FAILED
ON TEST

"L-O-N-G LIFE *with* THE SUREST KIND *of* SOCIAL SECURITY"

Year by year the high quality of products, under the scrutiny of testing, increases.

Year by year, as quality increases, the cost for service decreases.

Wherever customer and manufacturer display a friendly interest in high quality, business relations are on a solid foundation.

The enlarged facilities at the new home of E T L permit extension of this friendly cooperative stimulus to all items of electrical distribution and utilization.

A booklet outlining the various services available in the new E T L Building will be mailed you upon request.

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NEW YORK, N. Y.

ELECTRICAL TESTING LABORATORIES

NEWS ABOUT PEOPLE

D. S. Funk Becomes Head of Sangamo Electric Co.

Donald S. Funk, vice-president and general manager of the Sangamo Electric Co., Springfield, Ill., was elected president and general manager at the

recent meeting of the board of directors. Mr. Funk succeeds the late Robert C. Lanphier as executive head of the company.

Mr. Funk started with the company 22 years ago, after graduation from Yale. Mr. Funk has long been active as a civic leader in Springfield.

•

▶ MAX W. BABB, president Allis-Chalmers Manufacturing Co., Milwaukee, was recently honored by having conferred on him the degree of doctor of laws by Iowa Wesleyan College at Mount Pleasant, Iowa. Dr. Babb is an alumnus of both Iowa Wesleyan and the University of Michigan.

▶ CLYDE W. ORGAN has been named to succeed the late George A. Bengel as manager of the Springfield division of the Central Illinois Light Co. Mr. Organ has served as general superintendent of the electric department of the company's Springfield property for the past 20 years. He previously was associated with the affiliated utilities in Springfield, Ohio. A member of the Springfield Chamber of Commerce, Mr. Organ is 54 years old and is a native of Illinois.

•

Consumers Power Appoints New Division Managers

A series of recent transfers and promotions in the operating staff has been announced by the Consumers Power Co., Jackson, Mich.

Harley H. Stephens, manager of the Alma division since 1925, has been named superintendent of electric distribution with offices in Pontiac. David H. Gerhard, general office power sales engineer for many years, succeeds Mr. Stephens as division manager at Alma. Karl Jackson, superintendent of electric distribution at Pontiac, has been named to succeed Daniel H. Beardsley, veteran superintendent of electric distribution at Alma, who has retired. Charles D. Malloch, power sales engineer of the Grand Rapids division, has replaced Mr. Gerhard in the general office at Jackson. W. B. Tippy, formerly senior sales engineer of the Flint division, has been appointed assistant to division manager of the Kalamazoo division. Ray B. Withey has succeeded Mr. Tippy as senior power sales engineer of the Flint division.

Mr. Stephens has a 30-year service record. He joined a predecessor of the Consumers Power Co. at Kalamazoo in 1907 as lineman. Mr. Gerhard has been with the company for about fourteen years, always as a member of the general office staff until his recent promotion. Mr. Jackson has been superintendent of electric distribution at Pontiac since 1935. Previously he was an electric distribution engineer at Pontiac for fifteen years. Still earlier he spent four years in the electric distribution engineering department of the Jackson division.

Appointed Vice-President of American Steel & Wire

Harvey B. Jordan has been appointed vice-president of the American Steel & Wire Co. He will be in charge of operations and succeeds M. W. Reed, who

has been made chief engineer for Carnegie-Illinois Steel Corp. Both companies are U. S. Steel subsidiaries.

Mr. Jordan has been in the employ of American Steel for 25 years, having started as a chemist at central furnaces and docks in Cleveland during his college vacation period in the summer of 1914. He moved up through the ranks until he was named assistant vice-president in January, 1937, holding that position until the present time.

•

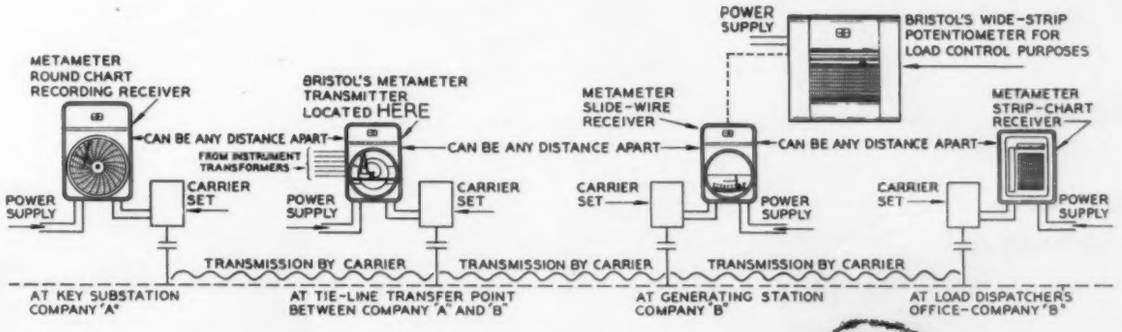
▶ CHARLES A. TATTERSALL, secretary of the Niagara Hudson Power Corp., has been appointed chairman of the utilities and amusements division of the 1939 campaign of the Greater New York Fund.

▶ J. H. SHEARER, president of the Pennsylvania Edison Co., was the guest of honor at a dinner held recently at the Penn Alto Hotel in Altoona when Veterans of Foreign Wars and the Amer-

DISTANCE and COST

your telemetering "stumbling blocks"?

Then, Bristol's Metameter System of Telemetering for operating over carrier-current channels is your answer! Mounted in your dispatcher's office, Metameter Receiver continually charts an actual picture of everything taking place at the remote load centers of your system. Records accurate readings of voltage, current, power, reactive volt amperes, and totalized load.


METAMETER ROUND CHART RECORDING RECEIVER
BRISTOL'S METAMETER TRANSMITTER LOCATED HERE
METAMETER SLIDE-WIRE RECEIVER
POWER SUPPLY
BRISTOL'S WIDE-STRIP POTENTIOMETER FOR LOAD CONTROL PURPOSES
METAMETER STRIP-CHART RECEIVER
CAN BE ANY DISTANCE APART
FROM INSTRUMENT TRANSFORMERS
CARRIER SET
POWER SUPPLY
TRANSMISSION BY CARRIER
AT KEY SUBSTATION COMPANY 'A'
AT TIE-LINE TRANSFER POINT BETWEEN COMPANY 'A' AND 'B'
AT GENERATING STATION COMPANY 'B'
AT LOAD DISPATCHERS OFFICE-COMPANY 'B'

Typical Metameter Installation Similar to One In Service For Transmitting Readings of Load At Tie-Line Transfer Point to Three Different Remote Locations.

Your dispatcher no longer need worry about what is going on at remote load centers and tie lines. With Bristol's Metameter System of Telemetering for operating over carrier-current channels he knows. In the accurate up-to-the-minute information which Metameter gives him, he has what he needs to keep in closer contact with remote load changes and to quickly analyze conditions hundreds of miles away.

Emergencies can't catch him unawares. Now he can anticipate abnormalities before they take place, and do what is necessary to correct the underlying disturbing cause. He can act *promptly on the basis of facts.* He can direct the generation and transmission of power *intelligently,* as well as economically and easily.

For full information, and helpful engineering data on Metameter carrier-current telemetering, write for Bulletins 515E and 530E.

THE BRISTOL COMPANY
WATERBURY, CONNECTICUT
Branch Offices: Akron, Birmingham, Boston, Chicago, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Seattle. Canada: The Bristol Company of Canada, Limited. Toronto, Ontario. England: Bristol's Instrument Company, Limited, London, N.W.10

BRISTOL'S METAMETER System of Telemetering

METAMETER FEATURES AT A GLANCE!

Readings are transmitted as a function of time. Accuracy is not affected by the characteristics of the transmitting channel.

Particularly suited for operation over channels commonly available in power systems.

For use between transmitter and receiver, any two-wire circuit or its equivalent is suitable including private wires, telephone circuits or carrier channels.

Telemetering is possible over any distance,—with record made on a strip chart or a large easy-to-read circular chart.

Simple in construction. Only three principal parts—transmitter, receiver and inter-connecting circuit. Transmitter and receiver are self-contained instruments. Together they weigh less than 40 lbs.

Now used not only for electrical quantities, but also for telemetering fluid pressure, water level, temperature, flow, mechanical motion and gate position. Hundreds of installations today in successful operation in forty-two states and five foreign countries.

Specify THE **FARGO** UNIT CONNECTOR

+FOR HIGH CONDUCTIVITY

At low torque Fargo Connectors *"grip like a vise"*, give a perfect contact, high in conductivity, low in voltage drop. Jaws are vibration-proof.

+FOR REPEAT USE

You can use Fargo Connectors over and over again. Fargo design distributes service strains evenly, Fargo EVERDUR construction is distortion proof.

+FOR EASY APPLICATION

The one-piece Fargo has no parts to lose, is always threaded. Just hook it on the run wire, insert the tap and tighten the bolt.

• • •

Ask your L-M representative to show you a sample, or write to South Milwaukee, Wisconsin, for Fargo Connector information.

Made by
Fargo Manufacturing Co.
DISTRIBUTED BY

LM
LINE MATERIAL CO.

ican Legion joined in a testimonial tribute to one of Altoona's most outstanding citizens. Tribute was paid to Colonel Shearer by men representing business, industry, civic groups, veteran units, patriotic organizations and citizens' groups. Approximately 500 persons attended.

▶ R. E. BRENNAN, formerly general auditor for Portland General Electric Co., Portland, Ore., has been appointed comptroller to serve in the capacity of executive accounting officer and to perform special duties required by the president. He is succeeded as general auditor by Lester G. Park.

▶ ANDREW W. ROBERTSON, chairman of the Westinghouse Electric & Manufacturing Co., has been appointed sponsor of New York World's Fair advance ticket sale to electrical industries.

▶ FRANK H. SWAYZE, formerly vice-president, has been elected president of the Whitney Blake Co., New Haven, Conn., to succeed Henri Sadacca. Mr. Swayze had previously been associated with the Western Electric Co. and the Graybar Electric Co. for 37 years.

▶ S. R. SCHEALER has been made professor of electrical engineering and acting chairman of the department of electrical engineering at Vanderbilt University, Nashville, Tenn. Prof. Schealer was for 15 years on the teaching staff of Lehigh University, his alma mater, and from 1927-35 was associated with Duke University.

▶ GEN. CHARLES KELLER has been elected a member of the board of directors of Public Utility Engineering & Service Corp., to fill the vacancy caused by the resignation of Henry C. Cummins, who has been elected vice-president in charge of operation, Northern States Power Co., Minneapolis. General Keller has been identified with Public Utility Engineering & Service and its predecessor company since 1923 as an engineer on hydro-electric and other engineering projects.

▶ FOREST BOOKMAN has been elected a vice-president of the Railley Corp., Cleveland, in charge of the shade department. J. R. GODFREY has also been elected to a vice-presidency in charge of the Chicago office. Both Mr. Bookman and Mr. Godfrey have been with the company practically since its inception.

▶ WILLIAM H. PRICE, JR., has resigned as vice-president in charge of sales of Carrier Corp. For the past three years he has served in the executive capacity as head of the sales organization. Mr. Price entered the heating and air conditioning business in 1927 when he joined the York Heating & Ventilating Corp., which became a part of Carrier Corp. in 1931. During his early Carrier activities he had charge of the programs for residential air conditioning and national distribution of both installed and packaged air-conditioning equipment through dealers. While vice-president in charge of sales he was responsible for the direction of the sales policies. Recently Mr. Price was elected president of the Air Conditioning Manufacturers' Association.

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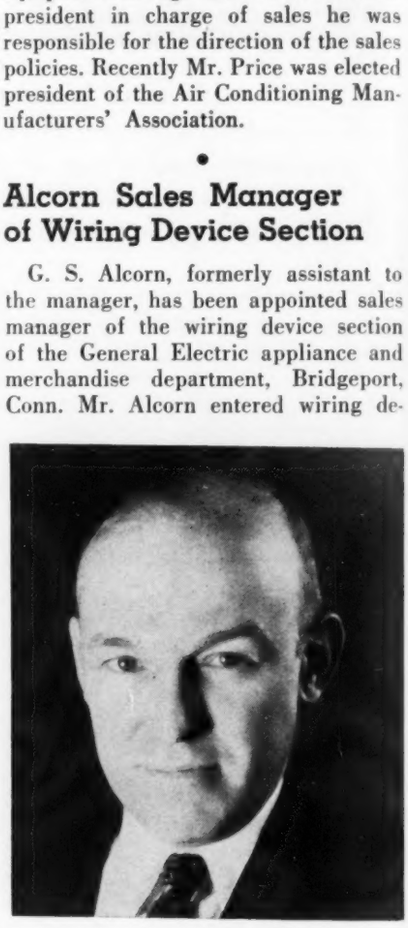
Alcorn Sales Manager of Wiring Device Section

G. S. Alcorn, formerly assistant to the manager, has been appointed sales manager of the wiring device section of the General Electric appliance and merchandise department, Bridgeport, Conn. Mr. Alcorn entered wiring de-



vice engineering at Schenectady in 1910, later transferring to sales and becoming a specialist with headquarters in Boston.

He was successively headquarters specialist at Bridgeport in 1921, for wiring devices, and in 1926 regional specialist for New York state on all Bridgeport products, including wiring devices, conduit, wire and cable, fans and vacuum cleaners. He became assistant to the manager of the wiring device section in 1928.

•

▶ LESLIE E. LYNDE has been appointed manager of the central station division of the Westinghouse Electric & Manufacturing Co., New England district, following the promotion of Frank L. Nason to the district managership of the company. Mr. Lynde entered the East Pittsburgh works of the company in 1920, four years later was transferred to the New York office, and in 1927 was made manager of the transportation division at Boston. He will continue in the latter position, with headquarters at 10 High St., Boston.

OBITUARY

▶ DAVID L. GASKILL, former utility executive, died March 9, in his seventy-seventh year. Mr. Gaskill was the founder of the Greenville (Ohio) Electric Co. and served as its president until 1927. For a number of years he was secretary of the old Ohio Electric Light Association.

▶ ROYAL R. CRATES, who until December served as chief engineer on the building of the electrical distribution system for the city of Memphis, Tenn., died in Fort Wayne, Ind., March 10, of tuberculosis. He was 39 years of age. He had been called to Memphis three years ago from Michigan, where he had been associated for fourteen years with the Consumers Power Co. A graduate of Purdue University, Mr. Crates was a member of the American Institute of Electrical Engineers.

▶ WILLIAM M. MARTIN, resident manager of the New York Power & Light Corp., Albany, died September 9 in that city, in his fiftieth year. Mr. Martin had been connected with the Albany branch of the power company for ten years. His first position was that of assistant superintendent of power supply operation. In 1930 he was made general superintendent, then manager of the capital district power supply. He held that position until 1935, when he was appointed resident manager of the Albany area. Mr. Martin was associated with the West Penn Power Co. in Pittsburgh and the Monongahela West Penn Public Service Co. in Parkersburg, W. Va., before coming to New York. He was a native of Glasgow, Scotland.

▶ ERNEST L. CLIFFORD, district sales manager of the Babcock & Wilcox Co., in Detroit, died February 8. Mr. Clifford had been connected with Babcock & Wilcox since 1927, as salesman in the Chicago office and then manager of the Detroit office. The first ten years after graduation from Massachusetts Institute of Technology he spent with various firms in Boston, Washington and Chicago as draftsman, engineer and superintendent of construction in heating and power plant work. He then was connected for eight years with Cannon-Swenson Co., Chicago. The ensuing five years were spent as engineer with McClellan & Junkersfeld of New York City on the construction of the Cahokia power station at St. Louis. He was a charter member of the Engineering Society of Detroit and was also a member of the American Society of Mechanical Engineers and the Western Society of Engineers.

THIS APPROVED METHOD GIVES *YOU* SAFER FASTER POLE UNLOADING

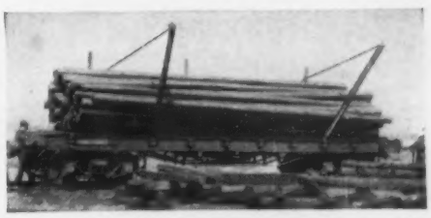
• *View of Car braced with Acme Unit-Load Bands*

The Acme Unit-Load Method of bracing cars of poles for shipment has been approved by the Loading Rules Committee of the A.A.R. And because it enables safer, faster, more economical *unloading* it is preferred by more and more pole receivers in all parts of the country.

The low-cost, Unit Load Method, developed by Acme, is simple and easy to apply. The flat Acme Bands are placed around the load and across the stakes then tensioned and sealed. The danger of damage, delay or loss in transit is eliminated.

The procedures suggested for safer, faster and more economical unloading are contained in the illustrated booklet—"Pole Shipments and Unloading Procedures"—a copy should be in your files for ready reference. Write for it today—it may be the means of helping you increase safety—decrease costs.

• *Showing how safely and easily bands are removed from side opposite unloading side.*



• *Tension is gradually eased and poles roll safely off the Car.*

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Branches and Sales Offices in Principal Cities

ACME STEEL COMPANY,
2845 Archer Ave., Chicago, Ill.
Send me a copy of the booklet about POLE SHIPMENT with suggested *safe* Unloading Procedures.

Name .....
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MANUFACTURING - MARKETS

Allis-Chalmers Nets $1.44 Common Share

Net profit of Allis-Chalmers Manufacturing Co. for 1938 was $2,553,946 after charges, taxes, interest and depreciation, equivalent to $1.44 a common share, as against $7,841,167, or $4.42 a share in 1937.

At the end of 1938 the company had unfilled orders of $10,411,411, against $21,243,567 at the end of 1937. Orders booked during the year totaled $66,711,281, against $94,778,845 in 1937, and sales billed totaled $77,543,437, against $87,353,616. The company reported that it had cash of $11,677,994, against $6,734,859 at the end of 1937. Inventories were $25,301,844, against $36,723,613.

Otto H. Falk, Chairman, and Max W. Babb, president, stated in the annual report that the company's purchase commitments at December 31, 1938, of materials for future delivery are considered not in excess of current production requirements, and the contract prices of the commitments were not in excess of current market prices at that date.

During the year development and experimental expenditures amounted to $2,335,261, against $2,053,581 in 1937. Capital expenditures were $4,150,433. At the close of 1938 there were 11,511 employees, as against 17,728 at the end of 1937. Wages totaled $22,720,053, against $28,800,863.

•

Huge Refrigerator Order Placed in St. Louis Area

Brown Supply Co., distributor of Stewart-Warner appliances in the St. Louis territory, announced recently the acceptance of what is believed to be the largest single order to date for 1939 electric refrigerators, to be installed in a St. Louis apartment house now under construction. The contract, signed recently with H. B. Deal & Co., St. Louis, calls for 610 Stewart-Warner refrigerators to be delivered in stated quantities between June 15 and September 15.

U. S. housing officials declare the St. Louis apartment house project to be one of the most extensive now under construction or contemplated for 1939.

•

Lincoln Electric Opens Seattle Branch Office

Lincoln Electric Co., Cleveland, Ohio, announces the opening of a factory branch office in Seattle, Wash. The new office, with warehouse in connection, will be located at 1914 Utah Avenue. J. B. McCormick, who formerly represented the company in Fresno, Calif., and recently in Spokane, Wash., will be in charge of the branch.

The company recently held its annual regional sales meeting in San Francisco, Calif., which was in charge of C. M. Taylor, vice-president and sales manager. J. F. Lincoln, president of the company, addressed the Chamber of Commerce of Los Angeles, as well as a joint meeting of several technical societies during his visit to the West Coast.

•

G.E. Gets Navy Contract

General Electric Co. has been awarded a contract by the U. S. Navy for $204,943, covering gear control and switch.

•

Adds New Representatives

Proctor Electric Co., Philadelphia, has announced that W. H. Buchholz of Chicago, Ill., will represent the company in Wisconsin and northern Illinois and E. J. Lane of Maplewood, Mo., will represent it in Arkansas, southern Illinois, western Tennessee and eastern Missouri.

Workers Get 32% of Company Income

Workers of the Johns-Manville Corp. received 32 cents of every dollar received from the company's customers in 1938, stockholders got 2 cents and 1 cent was put aside as a reserve, according to the annual report to employees, issued by Lewis H. Brown, president. The other 65 cents of the sales dollar was required for new materials, transportation, taxes and other expenses.

After declaring that poor business conditions had made 1938 an unsatisfactory year, Mr. Brown said: "I believe that we made real progress in getting ready to go forward once general conditions get better. It is not possible for me to predict when this turn will come. . . . But at this time business is better than it was at the start of 1938, and I feel that our prospects for 1939 are somewhat brighter."

•

Carrier's President Predicts Rise in Air Unit Sales

The air-conditioning industry should show a 25 per cent increase in sales this year by comparison with 1938, J. I. Lyle, president of the Carrier Corp., said at the first showing of the corporation's 1939 conditioning units held recently in Chicago. Salesmen from all sections of the Middle West attended. Carrier's business, the president continued, has been running well ahead of last year, with heavy commercial units and installations in the lead. Carrier's new line consists of ten models, of which six are self-contained for home and business use.

•

Plans Plant Expansion

International Harvester Co. plans a $3,000,000 modernization program for its tractor works in Chicago as part of its current schedule of plant rehabili-

tation and rearrangement. The modernization program for all of the company's plants calls for an expenditure of $12,000,000.

•

Profit Statements for 1938 Reported

Earnings reports covering 1938 operations have recently been issued as follows:

COPPERWELD STEEL—Net profit, $647,485, equal to $3 each on 215,857 shares of $10-par capital stock outstanding at year-end. Net profit in 1937 was $619,046, or $2.88 each on 214,256 shares then outstanding. On January 25, 1939, the 215,857 shares of $10-par value were reclassified into 431,714 shares of $5-par value. In his remarks to stockholders in the company's report, S. E. Bramer, president, stated: "The management is pleased with the showing of the company during 1938, particularly in view of the general business trend. The outlook for the company is encouraging in view of the possibility of increased public utility purchases this year, and we look forward to 1939 with optimism."

WORTHINGTON PUMP—Including domestic subsidiaries, net profit, $29,710, after provisions for doubtful accounts and $83,325 write-off of obsolete inventory. This is equal to 23 cents each on combined 129,402 shares of $100 par, 4½ per cent cumulative prior preferred stocks. In 1937 the net was $1,621,979, equal, after dividend requirements on the preferred stocks, to $3.79 each on 245,932 common shares. Current assets as of December 31 were $13,281,413 and current liabilities were $5,549,401.

CURTIS LIGHTING—Including subsidiaries, net loss $54,880, including $10,244 net income of Curtis Lighting of Canada, Ltd., a wholly-owned subsidiary, and after depreciation, interest, taxes, etc. This compares with net loss of $25,970 including $18,732 net income of Curtis Lighting of Canada, in 1937.

REVERE COPPER & BRASS—Including subsidiaries, net loss, $2,125,407, contrasted with net profit in 1937 of $414,759, including $1,240,690 net profits realized on metal contents of sales and after inventory adjustment of $2,634,372, equal to $3.49 each on combined 24,587 shares of 7 per cent cumulative preferred stock and 94,118 shares of 5¼ per cent preferred stock.

•

City Plant Contract Let

City officials of Lathrop, Mo., have recently awarded a contract to Fairbanks, Morse & Co. for furnishing and installation of equipment for a municipal light and power plant. Contract price was $68,818. The award is subject to PWA approval.

New York Metal Prices

	Mar. 21, 1939 Cents per Pound	Mar. 15, 1939 Cents per Pound
Copper electrolytic	11.25*	11.25*
Lead Am. S. & R. price.	4.85	4.85
Antimony	11.25	11.25
Nickel ingot	35.00	35.00
Zinc spots	4.89	4.89
Tin straits	46.00	46.15
Aluminum, 99 per cent.	20.00	20.00

* Delivered Connecticut Valley.

How much is
UNNECESSARY WEAR
Costing You?

The STROBOTAC

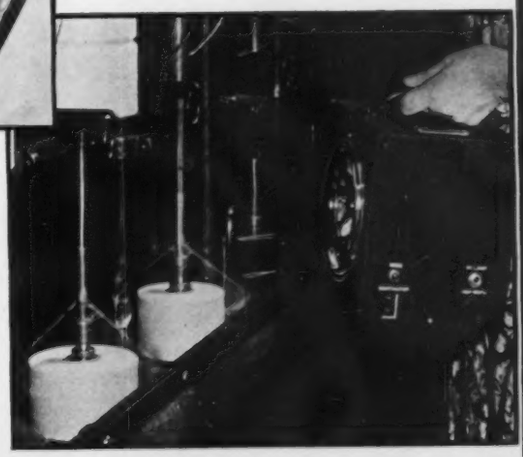
The STROBOTAC makes possible the "ounce of prevention worth a pound of cure". By stopping motion visually, or by seeing the exact performance of your equipment in motion as slow as a fraction of an rpm, this new hazard-detector shows you just what deficiencies are taking place . . . thereby suggesting preventive measures.

Thousands of research, production, maintenance and sales engineers have saved themselves significant sums of money with the STROBOTAC . . . and are stepping up profits with this simple, accurate, easily operated device. The STROBOTAC stops motion from *600 to 100,000 rpm.* Its large illuminated speed control is calibrated directly in rpm from 600 to 14,400 with an accuracy of 1%. The STROBOTAC requires no mechanical or electrical connection to the equipment under observation.

If you have any problem involving the observation of motion, the STROBOTAC is a simple, accurate and easily operated tool for securing the answer.

detects Power and Wear Losses caused by . .

Speed Variations
Torque Irregularities
Decreased Clearances
Improper Tension
Shaft Distortions
Lack of Synchronism
Loose Set Screws
Coupling and Belt Slippage
Worn Parts
and scores of other
mechanical deficiencies
while your equipment is operating at normal speed!



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Reliable
STRAIGHTLINE
DEAD ENDS

Flexible clevis Straight-Thru type FD— A compact and convenient low cost unit.

Long rigid clevis Straight-Thru type LD— Sturdy and easily handled.

Straightline Splice adapter type DD— For economy in stocking.

Rigid clevis type D — Compact and economical.

Reliable Straightline Dead Ends include design features of the Straightline Splice. Straight-Thru type permits easy take-up of slack.

Reliable
ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES

Field Reports on Business

Electrical manufacturers report an increase in orders for certain types of equipment. Some utilities have increased construction budgets and are preparing for actual building as soon as weather conditions are favorable. Dealers report a good response in the appliance sales campaigns.

NEW ENGLAND

An interesting order for 115-kv. transmission line cable involving more than $100,000 has been received by the General Electric Co. from the Narragansett Electric Co. (N. E. Power System subsidiary). An order for a 40,000-kva. transformer to be installed on this job will be placed soon. Recently Simplex Wire & Cable Co. filled an order from the city of Chicago for 20,000 ft. of 3-pair No. 12 stranded submarine telephone cable insulated with Anhydrex rubber and armored with No. 8 B.W.G. galvanized steel.

A Texas industrial plant has purchased a third 8,600-kva. steam-generating unit through a Boston engineering house on a development program involving nearly a third of a million dollars in electrical modernization. A prominent manufacturer of electric furnaces located in this area reports the shipment to date of 23 steel treatment furnaces aggregating approximately 2,000 kw. ranging from 100 kw. to 170 kw. in capacities. Inquiries from machine and automotive accessories for special-purpose electric furnaces are being received in good volume and represent installations, according to one engineer, costing over $200,000.

Orders for small motors and small switch and control apparatus are steady. In the opinion of one representative demands for rush deliveries are becoming more frequent, especially from machine manufacturers who are receiving orders for early deliveries. Negotiations for commercial electrical cooking installations are progressing; in the Boston area over 150 kw. capacity will be required in new equipment to be purchased soon.

Wiring supplies for light and power for new construction in this area will be in good demand, according to recent announcements which state that loan contracts have been signed by the Federal Housing Authority which will provide for financial assistance in promoting the construction of 871 housing units in Lowell and New Bedford.

CHICAGO

General conditions again showed improvement over the previous week and business continued to widen the margin over a year ago. The showing made in retail activity was especially encouraging as rather sharp gains were registered. Industrial activity continued to forge ahead slowly and slight improvement in employment and payrolls was becoming evident. Electrical power output increased appreciably, while residential construction continued to move steadily upward.

Reports from electrical manufacturers indicate a substantial upward trend of sales in a majority of cases. Utility purchases are increasing as considerable new construction and expansion work is beginning to open up.

Additional REA allotments total $1,477,000 for 1,352 miles of line to be constructed in several Illinois counties. New PWA contracts awarded will include $435,000 for electrical work in public buildings. One manufacturer reports a sharp increase in orders for outdoor lighting equipment with sales averaging 27 per cent above a year ago. Retailers report a substantial increase in appliance sales, some items running as much as 90 per cent over last year at this time.

Of 30 manufacturers reporting to the Electric Association, 18 show a rise in net sales during February over January, while 22 had a gain over February, 1938. Electrical contractors are receiving a considerable volume of work as a result of the EHFA wiring campaign.

NEW YORK

Increased activity in electrical manufacturing plants is pointing the way to higher profits so far this year. A rise in orders has been noted by several companies. The feeling is that spring business will be good. Utilities continue to report a good increase in power use which is pointing the way to expansion of plant facilities.

Several good-sized contracts have been reported of late. General Electric has received one of the largest air-conditioning contracts in its history. The order is for 1,000 specially built room conditioners for a large Texas corporation. Westinghouse has closed power and lighting equipment contracts for the New York World's Fair, supplying a large percentage of the $1,400,000 contracts so far let.

Residential building activity continues its upward trend. At no time since 1929 has the February volume equaled the total for the 1939 month. A gain of 98 per cent over the February, 1938, total was registered. Appliance manufacturers see a good gain in business in this market. Utilities are pushing the sale of appliances in their load-building drives.

PACIFIC COAST

The building permit volume for seven Western states is running 18 per cent more this year than last, which, in turn, was 5 per cent over 1937. California is supplying 80 per cent of the total, a 30 per cent increase. By mid-year the present building activity will be augmented by many housing projects, such as $1,000,000 Los Angeles suburb and 500 homes for Mexican migrants in Los Angeles County, $2,000,000 Long Beach project and San Francisco's first $2,000,000 unit of its $15,000,000 program.

Allis-Chalmers presented low bid furnishing and installing four 103,000-hp. turbines for Shasta power house, their total being $1,769,400, plus $97,000 for the governors. Much heavy machinery is being bought, recent awards and low bids including $61,000 for 4,000-kva. transformers for Bonneville; $252,650 for two circuit breakers, each 287.5 kva., and lightning arresters for Los Angeles switchyard to take third line from Boulder; $26,012 for Petersen coils and voltage regulators for Cheyenne substation of Kendrick project, and $42,000 for sixteen control cubicles, $8,200 for circuit breakers, $23,000 for 2,000-kva. transformers, all for Oakley section of California Central Valley project.

Major appliance sales are somewhat below expectations, particularly in the Bay area, though the effect of predicted tourist spending of exposition visitors will probably bring final results above 1938.

Recent Legislation

Developments in the various state legislatures on measures affecting the electric light and power industry are as follows:

INDIANA—Senate has passed a bill requiring the state Public Service Commission to transmit to the township and county assessors and county auditors the latest valuation of public utility property for rate-making purposes. The vote was unanimous. A bill in the Senate amending the public utility law to extend the limit of total preferred stock and funded debt of utilities and to provide for the purchase or lease of other utility property under new terms, has passed 65 to 14 in the House. The House has passed a bill which provides that money in reserve and depreciation funds of municipal utilities not immediately needed for construction or improvements be invested only in United States government bonds, certificates or treasury notes, bonds of the state or any county, township, city or town, except in securities of the municipality where the utility is located. Income from these investments is to be used only for the fund from which it was taken. The bill passed unanimously. House bill regulating REMC organizations passed the House 84 to 0. The bill changes terms for directors from one year to staggered terms ranging from one to three years, each district to nominate a man, and provides that municipal or private utilities must obtain approval of 50 per cent of non-electric farm owners before extending lines in rural areas. The bill provides a penalty of $1,000 a mile for line extensions not authorized by the state Public Service Commission. House has passed a bill by unanimous vote amending the REMC act to permit similar organizations in adjoining states to serve Indiana territory that cannot be served profitably by Indiana REMCs. The bill specifies that members shall not be liable for any corporation debt except their own electrical bill or unpaid amounts on their contracts. It gives the state Public Service Commission power to permit REMCs of other states to extend lines to border localities of Indiana and amends act titles to change names to Electric Corporation or Co-operative. The bill carries an emergency clause and, if passed, will be in immediate effect on the Governor's signature. By a vote of 76 to 7 the House passed a bill which permits municipally owned utilities to form a retirement fund for employees. The bill provides that the utility shall match contributions of employees to create the fund. This bill also carries an emergency clause. House bill, which provided that any utility rate reduction order might become effective as of the date of the petition instead of awaiting formal action of the state Public Service Commission, has been killed in commitee.

MARYLAND—Bill has been introduced in the General Assembly authorizing the courts to fix utility rates under certain circumstances. If the Public Service Commission failed to take action within 60 days, under the provisions of the measure, the municipal or county authorities would be authorized to appeal to the courts provided the action was approved by a two-thirds vote of the Council or the Board of County Commissioners. Appeal from the action of the court to the State Court of Appeals would be provided. This bill was branded as untruthful, "defamatory and absurd" by the Public Service Commission. In a letter to Milton Tolle, chair-

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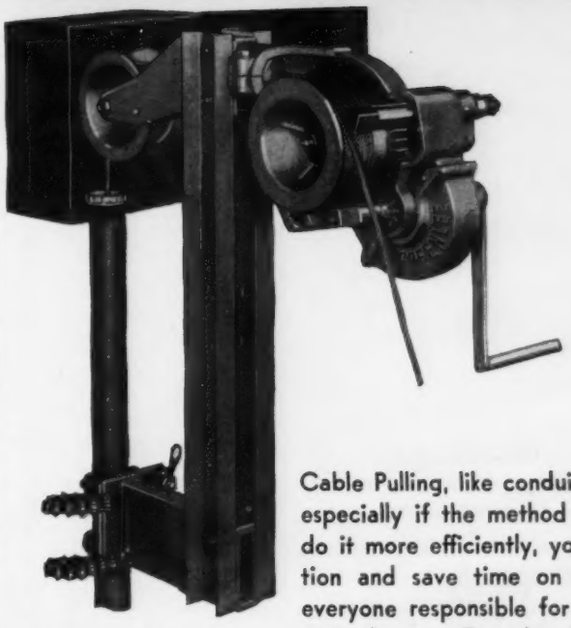

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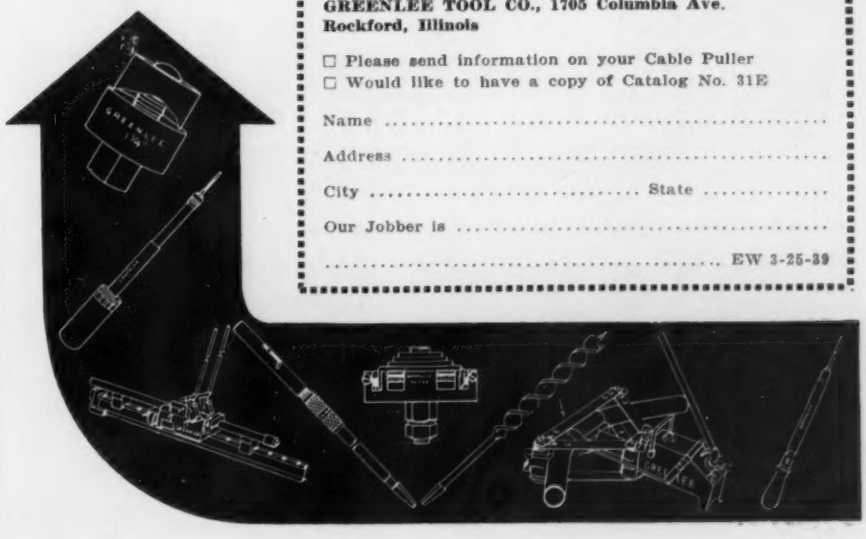

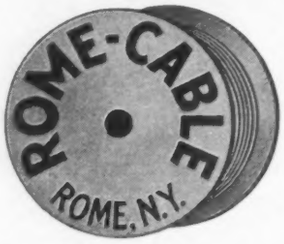

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man of the House judiciary committee, the commission stated the bill reflects upon the diligence, honesty and integrity of the commission.

WISCONSIN—Assembly has passed by a 53 to 41 vote the Budlong bill which provides for the abolishment of the Wisconsin Development Authority. The WDA, known as the "little TVA," was authorized by the 1937 legislature to function as a private non-profit corporation to promote public ownership of utilities. In June, 1938, the state supreme court restricted its activities to educational work on rural and municipal electrification. The bill was sent to the Senate, which is expected to take similar action.

MISSOURI—A bill introduced in the House prohibits utility companies from manufacturing, selling or leasing any appliance consuming or using gas, electricity or water. Another House bill requires Missouri Tax Commission and assessors to use same valuation as the Public Service Commission.

CONNECTICUT—General Assembly is considering a bill which would prohibit the manufacture, sale and distribution of appliances by public service companies.

OKLAHOMA—A bill has been introduced in the House which would require public utility corporations to report their valuation at the same amount both for taxation and rate making purposes.

PENNSYLVANIA—Any municipality, under a measure which has been introduced in the Legislature, would be authorized to construct, acquire, own, operate, sell or lease public utility facilities to enable it to furnish public utility service within or beyond its corporate limits.

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Owens-Corning Opens Six Branch Sales Offices

Owens-Corning Fiberglas Corp. is opening six branch sales offices in as many cities in the United States—Boston, New York, Pittsburgh, Cincinnati, Detroit and Chicago—in the first of a series of expansion moves in 1939, according to an announcement made by George E. Gregory, general sales manager of the company.

The following appointments have been made: C. H. Soderberg, sales representative Boston office; Charles L. Day, special representative for marine products in the New York office; W. B. Dias, New York sales representative for all commodities; James L. Elwood, Pittsburgh sales representative; John B. Schneller, Detroit representative; D. S. Smith, Cincinnati sales representative; G. F. Becker, Chicago sales representative, and Frank L. Myers, Chicago sales representative.

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Cleaner Sales Decline

Vacuum cleaner sales in January totaled 102,599, compared to 124,760 January, 1938, and 126,153 in December, 1938, according to industry figures made public by C. G. Frantz, executive secretary of the Vacuum Cleaner Manufacturers' Association.

Municipal Plants

AURORA, IND.—Indiana Supreme Court has ruled in favor of the Public Service Co. of Indiana in its appeal from a decision of the Dearborn County circuit court relative to an election held in this city, on taking over the company's property as a municipal project. The appeal was from an order appointing appraisers for the condemnation of the electric, gas and water works property of the company in Aurora. The court said most of the questions presented by appellants were decided in the City of Lebanon vs. Public Service Co., but that there is a question as to the validity of the election on which the appellee seeks to condemn the properties. It is pointed out that appellant owns three separate and distinct properties, or utilities, and that the law contemplates an election whether "a utility" is to be purchased, not an election whether all the property of the owning corporation is to be purchased. That in this case voters balloted on whether the city should buy all three "utilities" and there was no election whether the gas, light or water utility should be purchased, to permit the voter to vote in any way as to the separate utilities owned by the appellant. The language of the statute is analyzed and the decisions reviewed with a decision: "It was error to appoint appraisers."

PARIS, KY.—Court of Appeals ruled that city cannot prevent Kentucky Utilities Co. from competing with the city's electric plant.

PADUCAH, KY.—Municipal power plant ownership advocates have forced a referendum for the coming November election on an ordinance calling for sale to the Kentucky Utilities Co. of a twenty-year franchise, by presenting to the Board of City Commissioners a petition bearing names of 2,803 voters.

CHEBOYGAN, MICH.—Residents will vote at the spring election on whether or not to amend the city charter to provide for municipal ownership of an electric light plant and distribution system. The proposed amendment would authorize the city to construct and operate an electric utility, or to purchase by condemnation the Cheboygan plant and facilities of the Michigan Public Service Co. The cost of purchase or construction would be met by mortgage bonds based on revenue with provisions for a 20-year franchise for bondholders if it became necessary for them to foreclose.

FULLERTON, NEB.—Voters have declined to approve condemnation of Iowa-Nebraska Light & Power Co. property and acquisition by the city. The proposal failed to get the necessary 60 per cent majority required in such a special election. The vote was 292 in favor of condemnation and 279 against.

WAPAKONETA, OHIO—City has been relieved of the necessity of constructing a municipal light plant by a decision of the Ohio Supreme Court, affirming the Third District Appellate Court. After the city had planned to issue bonds and erect a municipal plant with the aid of PWA funds, a new rate schedule was arranged with the Central Ohio Light & Power Co., and proceedings for the new plant were then repealed. The city solicitor, however, brought suit to compel the city to proceed with erection of a municipal plant, notwithstanding the new rate ordinance.

EDGERTON, WIS.—Wisconsin Supreme Court has affirmed a previous circuit court

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decision which set aside public service commission orders fixing the purchase price of the Wisconsin Power & Light Co. properties in Edgerton. On an appeal from the commission's order, the Dane County Circuit Court ruled that the order allowing the city to purchase for $95,000 was void. The Supreme Court agreed in this decision.

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Recent Rate Changes

COMMONWEALTH EDISON CO. and subsidiaries will reduce their rates $2,208,000 annually as the result of an order by the Illinois Commerce Commission. The new rate reductions are divided among the companies as follows: Commonwealth Edison retail commercial rates, $854,000; Public Service Co. of Northern Illinois retail commercial rates, $399,000, and residential rates, $741,000; Western United Gas & Electric Co. commercial rates, $87,000, and residential, $62,000, and Illinois Northern Utilities Co., commercial rates, $65,000. From the office of James Simpson, chairman of Commonwealth, the following statement was made: "The reductions in rates ordered by the commission were accepted by the companies after thorough studies by the companies and the commission. The new commercial rates not only represent a further step in lowering the cost of electricity to stores and small business establishments in northern Illinois, but also effect a desirable simplification of rate schedules. . . ."

CENTRAL NEW YORK POWER CORP. has announced, effective April 1, a cut in electric rates in the Utica area totaling $176,000 a year, subject to approval of the Public Service Commission. The utility filed new rate schedules affecting residential, farm and commercial customers in the territory formerly served by Utica Gas & Electric Co. and new residential and farm rates for customers in the territory formerly served by Northern New York Utilities, Inc., Rome district.

IDAHO POWER CO.'s customers in Ontario, Nyassa, Malheur, Vale and Halfway, Ore., and a large rural area in the Snake River valley in Oregon and Idaho will save $67,000 a year as a result of a rate reduction. Residential lighting reductions total $25,000 annually; commercial lighting, $15,000; commercial water heating, $7,000 and combined light and power, $20,000. Further reductions are expected soon.

WESTERN COLORADO POWER CO. has reduced residential and commercial rates in Montrose, Ouray, Durango, Telluride, Ridgeway and other communities in Colorado by $20,000 annually.

PHILADELPHIA ELECTRIC CO.'s new $1,650,000 rate reduction will benefit residential customers by more than $500,000 annually, small commercial customers by $600,000 and industrial customers by $450,000, Horace P. Liversidge, president of the company, stated.

WISCONSIN PUBLIC SERVICE COMMISSION has authorized rate reductions affecting about 11,000 business electric customers of the Wisconsin Gas & Electric Co. and the Wisconsin-Michigan Power Co., affiliate utilities, and totaling annual savings of about $83,000.

TIDEWATER POWER CO. has agreed to a reduction of $81,000 annually in residential and commercial electric rates according to Stanley Winborne, of the North Carolina Utilities Commission. The new rates are effective for April 15 meter readings.

CENTRAL OHIO LIGHT & POWER CO. has revised its urban light rates in Wooster about $35,000 a year, the reduction effective March 1. A reduction in commercial rates will be effective June 1. Twelve communities near Wooster will also benefit from the new rate.

ROCKLAND LIGHT & POWER CO. has filed a revision of electric rates with the New York Public Service Commission under which reductions are to be made effective in the commercial and primary power rates. It is estimated that the reductions filed to become effective at once will save consumers of the company $64,460 annually.

BONNER'S FERRY, IDAHO, municipal power system has announced a reduction in residential and commercial rates. Residential customers will now pay 6½ cents per kilowatt-hour for the first 40 kw.-hr. instead of the old 9 cents for the first 30. Commercial customers will pay 6½ cents for the first 100 kw.-hr. Other steps have been similarly lowered. As a result of the reduction, plans for an enlarged power plant on the Moyie River have been drawn up, and an application made for a PWA loan to match the city's $99,000 bond issue.

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REA Lets Contracts; Recent Allotments

The following construction contracts have recently been approved by the Rural Electrification Administration:

Pea River Electric Membership Corp., Clayton, Ala., Arthur B. Robertson, supt., Montgomery, contract to Harvey & Quinn, Pensacola, Fla., for building first section of project, 194 miles of line, 385 members; bid $102,998.

Southern Pine Electric Membership Corp., Brewton, Ala., Joseph T. Larkins, supt., Montgomery, contract to Harvey & Quinn, Pensacola, entire project, 274 miles of line, 600 members; bid $135,761.

Ozark Rural Electric Co-op. Corp., Fayetteville, Ark., E. H. Looney, supt., Waco, Tex., contract to Fritz Ziebarth, Long Beach, Calif., building first section, 291 miles of line, 700 members; bid $188,274.

Habersham Electric Membership Corp., Clarkesville, Ga., E. A. Lunceford, supt., Atlanta, contract to Gibson Brothers, Enterprise, Ala., entire project, 185 miles of line, 574 members; bid $111,970.

Jackson Electric Membership Corp., Jefferson, Ga., R. J. Kelly, supt., Atlanta, contract to W. A. Mathis, Athens, Ga., second section, 220 miles of line, 1,157 members; bid $143,309.

Canoochee Electric Membership Corp., Reidsville, Ga., Homer N. Daniel, supt., Atlanta, contract to Adamson-Brewton Co., Claxton, Ga., for building project, 269 miles of line, 619 members; bid $131,029.

Corn Belt Electric Co-op., Inc., Bloomington, Ill., T. H. Hafer, supt., contract to McCree and Co., St. Paul, Minn., first section, 313 miles of line, 680 members; bid $204,975.

Allen Wells County Rural Electric Membership Corp., Ossian, Ind., William O. Toy, supt., Indianapolis, contract to Miller-Baxter Co., Inc., Indianapolis, entire project, 227 miles of line, 812 members; bid, $183,771.

Salt River Rural Electric Co-op., Bardstown, Ky., Ralph F. Frizzell, supt., Louisville, contract to Henry Bickel Co., Louis-

ville, third and fourth sections of project, 242 miles of line, 800 members; bid $163,896.

Warren Rural Electric Co-op. Corp., Bowling Green, Ky., Lester Wright, supt., Louisville, contract to Killoren Electric Co., Appleton, Wis., for building second section of project, 168 miles of line, 447 members; bid $113,159.

Nolin Rural Electric Co-operative Corp., Elizabethtown, Ky., Ray W. Chanaberry, Inc., Louisville, Ky., engineer, contract to R. H. Bouligny Co., Charlotte, N. C., first section, 290 miles of line, 812 members; bid $193,774.

Tri-County Electric Co-op., Portland, Mich., Dolph Wolf, supt., Lansing, contract to Worthington Pump & Machinery Corp., Harrison, N. J., second generating plant and supplying equipment for project; bid $151,582.

Southern Pine Electric Power Assn., Taylorsville, Miss., H. L. Pickering, supt., contract to W. L. Coston and Sons, Bessemer, Ala., another section, 401 miles of line, 1,086 members; bid $216,765.

Hancock-Wood Electric Co-operative, Inc., North Baltimore, Ohio, C. C. Doyle, supt., and Gibbs and Hill, New York City, engineer, contract to Davis Hydaker Co., Lima, Ohio, first and second sections of project, 501 miles of line, 1,350 members; bid $319,666.

Claverack Electric Co-operative, Inc., Towanda, Pa., C. E. Jakway, manager, and Gibbs & Hill, New York, contract to Sordoni Construction Co., Forty Fort, Pa., another section of project, 217 miles of line, 720 members; bid $181,215.

Greenwood County, Greenwood, S. C., E. Lowden Brooks, County Supervisor, and D. T. Duncan, engineer, contract to J. B. Britton, Sumter, S. C., another section of project, 85 miles of line, 440 members; bid $52,512.

Magic Valley Electric Co-operative, Inc., Mercedes, Tex., Joseph H. Levermann, supt., and William C. Morrison, Waco, Tex., and J. E. Wilder, engineers, contract to Reinhart and Donovan Co., Oklahoma City, Okla., second section, 305 miles of line, 700 members; bid $164,740.

Mecklenburg Electric Co-operative, Boydton, Va., J. E. Smith, supt., and Herbert J. Baer, engineer, contract to Virginia-Carolina Electric Works, Norfolk, Va., another section of project, 198 miles of line, 527 members; bid $136,522.

Polk-Burnett Electric Co-operative, Balsam Lake, Wis., Wayne F. Kelly, supt., and Wisconsin Development Authority, Madison, engineer, contract to L. A. Bumgardner & Co., St. Paul, Minn., for first section of project, 180 miles of line, 530 members; bid $136,599.

Among the recent allotments made by REA are the following:

Washington—Benton Rural Electric Association, Prosser, J. B. Whitehead, supt., $25,000 to build 17 miles of line, 65 members in Benton and Yakima counties.

Wisconsin—Taylor County Electric Co-operative, Medford, Paul J. Fleischmann, supt., $81,000 to build 80 miles of line, 266 members in Taylor, Clark and Marathon counties.

Wyoming — Riverton Valley Electric Assn., Inc., Riverton, N. W. Beckman, president, $103,000 to build 91 miles of line, 236 members in Fremont county.

Texas—San Patricio Electric Co-operative, Inc., Sinton, C. A. Maedgen, pres., $195,000 to build 254 miles of line, 561 members in San Patricio, Bee and Live Oak counties. DeWitt County Electric Co-operative, Inc., Cuero, Thomas Shults,

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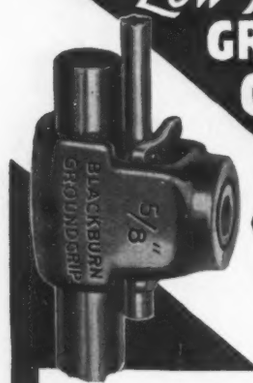

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pres., $172,000 to build 226 miles of line, 489 members in DeWitt and Gonzales counties. Victoria County Electric Co-operative Co., Victoria, H. A. Wischkaemper, pres., $140,000 to build 166 miles of line, 467 members in Victoria, Jackson and Calhoun counties.

VIRGINIA—Mecklenburg Electric Co-operative, Boydton, J. E. Smith, supt., $120,000 to build 119 miles of line, 412 members in Mecklenburg, Greenville, Brunswick, Southampton, Sussex, Pittsylvania, Charlotte and Halifax counties.

•

Sales Opportunities

LAKE CHARLES, LA.—Gulf States Utilities Company has approved plans for addition to local steam-electric generating station on North Ryan Street, with installation of new equipment. Cost reported close to $160,000. Work will be placed under way at once. Stone & Webster Engineering Corporation, 49 Federal Street, Boston, Mass., is consulting engineer.

WASHINGTON, D. C.—National Bureau of Standards, Connecticut Avenue and Upton Street, N. W., will soon begin erection of new high voltage electrical laboratory, for which an appropriation of $350,000 has been secured for building and equipment. Bids for building construction are being asked until March 31 by Public Buildings Branch, Treasury Department, Washington.

BUHL, IDAHO—Idaho Power Company, Boise, Idaho, has authorized expansion and improvements in outdoor power substation at Buhl, with installation of three 667-kva. tran-formers, regulators, oil switches and auxiliary equipment. Proposed to begin work soon.

NEWPORT, KY.—Andrews Steel Company. Ninth Street, plans installation of motors and controls, conveyors, electric hoists and other equipment in new addition to mill, with program to include modernization and improvements in present plant. Cost reported over $150,000. Tietig & Lee, 34 West Sixth Street, Cincinnati, Ohio, are architects.

SHEFFIELD, ALA.—Electric Metallurgical Company, 30 East 42d Street, New York, N. Y., plans early construction of a 44,000-volt transmission line in Colbert County, Ala., crossing Stinson Bay at point about 7 miles above Wilson Dam. Application for permission has been made. Line will extend from last noted place to new plant of company at Sheffield, where power substation will be located for step-down service for mill operations. Power supply will be furnished from Wilson Dam hydro-electric generating station by TVA, under contract with company. Work on initial units of new plant is being placed under way on 300-acre tract of land acquired a number of months ago. Plant will be used for production of ferro alloys, calcium chloride and kindred products. In addition to transformers, switchgear and other substation apparatus, installation will include heavy-duty motors and controls, electric furnace facilities, electric hoists, conveyors and other equipment. Entire project will cost about $5,000,000. Company is a subsidiary of Union Carbide & Carbon Corporation, first noted address.

KNOXVILLE, TENN.—Director of Purchases, Tennessee Valley Authority, Knoxville, receives bids until March 29 for switchboards for auxiliary power, lighting and battery charger service at hydro-electric power plant at Hiwassee Dam. Also, until March 28, for designing, furnishing, fabricating, galvanizing and delivering structural steel transmission towers for Wilson Dam-Pickwick Dam-Memphis, Tenn., 220-kv. transmission line, totaling about 4000 tons of material.

NORTH PLATTE, NEB.—Has postponed special election from April 4 to early future date, soon to be determined, to vote bonds for $360,000 for municipal electrical distributing system, including power substation and transmission line for connection with system of Platte Valley Power & Irrigation System, which will furnish power supply.

PLYMOUTH, N. C.—North Carolina Pulp Company, Plymouth, plans installation of motors and controls, conveyors, electric hoists and other power equipment in new addition to local sulphite fiber mill. Cost reported in excess of $500,000. Proposed to begin work soon. Company is a division of Kieckhefer Container Company, Delair, N. J.

OSKALOOSA, IOWA—Iowa Power & Light Company, Davenport, Iowa, plans extensions and improvements in electrical distributing lines at Oskaloosa, including primary and secondary systems.

PHILADELPHIA, PA.—Bureau of Yards and Docks, Navy Department, Washington, plans installation of motors and controls, regulators, conveyors and other equipment in new aeronautical engineering laboratory at naval aircraft factory, Philadelphia. An appropriation of $1,800,000 is being arranged at present session of Congress.

AMHERST, OHIO—Board of Public Affairs plans call for bids late in April for new municipal electric power plant and equipment. Bond issue of $145,000 has been authorized. Floyd G. Browne, Marion, Ohio, is consulting engineer, in charge.

BUFFALO, N. Y.—Niagara, Lockport & Ontario Power Company, Buffalo, plans extensions and improvements in transmission and distributing lines at Batavia, N. Y., and vicinity, including additions to rural electric system. Entire program reported to cost over $125,000.

AUSTIN, TEX.—Lower Colorado River Authority, Austin, will build new 69,000-volt transmission lines from hydro-electric power plants at Marshall Ford and Buchanan dams to point north of Austin, where power substation and switching station will be located, for service to a number of municipalities in that area. Financing has been arranged through federal aid.

SEATTLE, WASH.—J. R. Sousa and Gerald T. Mason, distributors of beverage products, care of W. J. Bain, Textile Tower Building, architect, plan installation of motors and controls, conveyors, loaders and other equipment in new bottling works and distributing plant at Third Street North and Mercer Avenue. Work on superstructure will begin soon. Cost estimated at $200.000, of which approximately $150,000 will be expended for machinery and equipment.

FAYETTEVILLE, TENN.—Has plans nearing completion for new distribution power substation, to be used for municipal electrical distributing system, now under way. New station will be connected with high-tension line of TVA, which will furnish power supply. Financing has been arranged through federal aid.

ATLANTIC CITY, N. J.—Atlantic City Electric Company contemplates extensions in steam-electric power plant, including installation of equipment.

BOOK REVIEWS

Tensor Analysis of Networks

By Gabriel Kron. Published by John Wiley & Sons, Inc., 601 West 26th Street, New York, N. Y. 635 pages, illustrated. Price, $7.50.

Engineering of all complexions is minded to reintegrate itself as to both its education and professional incidences. A formula, a tool and a structure are being sought to recover the innate unity of physical regimen when expanded into the utilitarianism of the civil, mechanical, electrical and chemical engineer. Many electrical engineers sense comparable lack of cohesion within the electrical field when they contemplate the tooling and procedure with which they solve the electrical interactions within, say, a transformer, a synchronous machine, an electron tube and a transmission mesh. The lack of resemblances is even more evident when magnetic and electrostatic manifestations are superposed. Engineers of the coming generation bid fair to escape this vague lack of cohesion and tensor analysis promises to be a major medium whereby such resolution into clarity is effectuated. To whatever degree that eventuates, the design and performance engineer today will be obsoleted by those who become his juniors. For that reason this first book specifically written for the electrical engineer is one of the important books of the decade. It is founded on the author's contributions to the advanced course in engineering conducted at the Schenectady works of the General Electric Company.

Here is shown how tensor analysis expands vector analysis from three to any, even an infinite, number of dimensions. More important it is shown how it provides a skeleton on whose vertebra and phalanges can be hung the multiplicity of variables and variable-interrelations that make a specific problem either one of complexity or hopelessness or else restricts the solution to a narrow scope. This is accomplished without presuming to be more than an introduction and without transgressing one-dimensional space configurations. This is, however, broad enough to lay down the implementing by which the engineer can solve, so as to illuminate the phenomena in an expansive way, such familiar explorations as multi-winding transformers, load-ratio control, multi-electrode tubes, interlinked magnetic and electric meshes, symmetrical components, circuit faults, networks and distribution systems. Let no reader be misled—there are practically no numerical solutions, the skeleton solutions merely painting the signposts to conventional vector solutions. Nor should any one misconstrue this review as promising a "readable" book. It will take plenty of good electrical engineers a week or two to absorb the first chapter securely.

•

Cases on Public Utility Regulation

By Irston R. Barnes. Published by F. S. Crofts & Co., 41 Union Square, West, New York. 984 pages. Price, $7.

While written essentially as a Yale text for students of utility regulation, this book has unique usefulness for the utility man who tries to solve the maze of legislations and litigations which constitute the only guide (short of the passing trend toward dignified horse trading) for regulated behavior of utilities. Here are the classic cases of the turn of the century and for once the author has had enough consideration for his students and readers to disclose how these cases arose, who were the major personalities, which commissions and lower courts concluded erroneously and which reasoning justice thereupon set the tacit rule for the future. Nicely balancing these antiquities are the New Deal era decisions on the Bond & Share, Ashwander, Clarion River and other cases before the Supreme Court, S.E.C. and F.P.C. These give the treatise a welcome freshness and modernity among a group of far less comprehensive and less equilibrated books of the last decade. In between are a multitude of cases that build the rest of the mosaic.

Opinionation of the author does not intrude into the text and it is even scarcely detectable in his choice of examples to afford a balanced view of all the prevailing provinces of state and federal regulation. Despite its origin in a law school atmosphere, the tone and complexion are so much less legalistic (citations do not perpetually interrupt the practical man's train of thought) that engineers, rate economists and commercial load builders will relish finding out from it why utilities have to conduct their affairs as they do in this thoroughly regulated era in American business.

•

Electrochemistry of Gases and other Dielectrics

By George Glockler and S. C. Lind. Published by John Wiley & Sons, Inc., 601 West 26th Street, New York. 469 pages. Price, $6.

The Committee of Electrical Insulation, Division of Engineering and Industrial Research of the National Research Council, prompted the preparation of this volume, intending it to be one of the monographs on dielectrics. Actually it goes far beyond in fulfillment of the objective of considering all forms of electrical discharge and all types of reactions, especially those that shorten the life of insulations. The theme is "how does electrical and thermal activation affect chemical reactions of organic materials and gases"? In the development there ensues a competent correlation of the authoritative research in the field of physical and chemical behavior of gases and other dielectrics under the influence of electric stress and discharge. Bibliographies are comprehensively numerous throughout.

Those intent on uncovering the reasons for limited life of electrical insulations in cables and apparatus need not be disappointed at not finding much experimental material bearing directly on their practical analyses, for instead they will find the basic interactions on simple substances.

•

Co-op to Construct Plant

Directors of the Tri-State Power Cooperative have voted to build a $500,000 generating plant on the Mississippi River at Genoa, Vernon County, Wis., as a rural electrification project. Transmission lines will cost an additional $478,000. The co-operative will serve Monroe, Crawford, Lafayette, Grant and Vernon counties in southwestern Wisconsin and border counties in Minnesota and Iowa.

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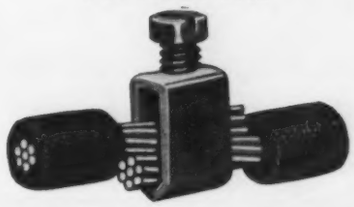

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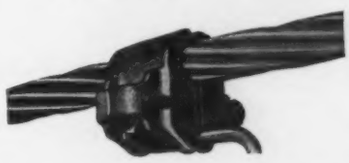

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Steel Plant and Utility Interconnected at 66 kv.

[*Continued from page 55*]

cycle, double-circuit river crossing tower located in the interconnection substation yard and shown in one of the illustrations. This tower carries the two 66-kv. circuits and two ground wires. The distance from the ground to the bottom arm is 250 ft. and from the ground to the overhead ground wire clamp is 310 ft., with 25 ft. spacing between the conductor arms and 20 ft. spacing from the top arm to the ground wire arm. The base is 66 ft. square.

Air navigation lighting, as required by the Bureau of Aeronautics, U. S. Department of Commerce, is installed on this tower and is automatically turned on and off by a Western "Photronic" cell permanently installed on one of the tower legs on the west side, the setting sun side, to assure turning on these lights when daylight fades.

The metering equipment of both companies consists of the usual current and potential transformers, with two sets of each owned by each company, so that either half of the bus can be taken out of service for maintenance and inspection, while the entire load is carried through the other half with complete registration during this time.

Metering Arrangement

Meters owned by Duquesne Light for registering power sold to and purchased from the customer are in three groups, assembled on one panel. One group of meters is for loads up to 48,000 kw., fifteen-minute demand; another group is for loads from 48,000 kw. to 65,000 kw., fifteen-minute demand, and the third group is for registering the dump energy which Duquesne Light may purchase from the steel corporation when available.

The meters for loads up to 48,000 kw. consist of one combined kilowatt-hour meter and a fifteen-minute demand meter, with a similar meter for checking purposes, and one reactive kva.-amp.-hour meter. A like group of meters are cut into service through transfer relays when the load exceeds 48,000-kw. demand. The meters for loads up to 48,000 kw. also register for loads above that figure. The meters for the dump energy from the steel corporation to the Duquesne Light consist of one kilowatt-hour meter and a similar meter for checking purposes. In addition, and for all loads, there is a graphic recording zero-center megawatt meter and a graphic recording zero-center power-factor meter to show the amount and direction of power and reactive flow. The steel corporation has similar sets of meters and metering transformers in its part of the substation, which meters are located in their room of the control house.

The relaying of this interconnection substation was quite a problem and was worked out jointly by engineers of the two companies. Essentially similar schemes of pilot wire protection were used by both, but the principles of operation on the part of the two companies differ.

Pilot Wire Relaying

On Duquesne Light's 66-kv. incoming lines Westinghouse type "HCB" pilot wire relays are used, with telephone pilot wire connections to adjacent substations. Supervision of the pilot wire is provided by comparison of the normal voltages on the pilot wire with the amount of load current flowing. This is read by the operators at two neighboring substations by open-circuiting the pilot wires and reading the millivolts supplied by each end. This is recorded hourly, along with other routine readings of currents and voltages in the station.

Back-up relay protection is provided for the incoming transmission lines by the usual power directional phase and ground relays, timed to select with the pilot wire relays and also to select with the rest of the relay settings on Duquesne Light's 66-kv. transmission system.

The steel corporation's pilot wire protection consists of General Electric type "GMB" pilot wire relays, with telephone pilot wires to its new 66-kv. substations—one in the Edgar Thomson Works and one in the Irvin Works. The pilot wire telephone cable also contains supervisory and control wires from the interconnection substation to the customer's system operator's office in the upper Duquesne works.

Bus differential, including phase and ground protection, is provided around the entire station bus, including the two incoming line breakers of Duquesne Light and the two outgoing line breakers of the steel corporation.

Public Address System Adopted for Power Plant

[*Continued from page 50*]

customed to prolonged exposures to high noise levels and automatically tunes them out. The higher voice frequencies are thus most intelligible.

In plant No. 1 turbine room the noise level is even higher than in plant No. 2, approximately 110 decibels. For the two speaker stations in this turbine room two Western Electric "sea sled" type units were installed at each of the two receiving stations. All microphones are of the close-talking type and there is no difficulty about picking up background noises even in the noisy locations. No booths are used. Even for the short period of time which the system has been in service it has proved itself very convenient. It was especially helpful for use between the old and the new control room during the period when the controls were being transferred and switchboard operators were required in both control rooms.

Salvage

[*Continued from page 53*]

knowledge they can see worth and usefulness in what to another man would be not worth saving.

The fitness of the situation goes beyond men and what they work on in the case of the Detroit Edison Company; it happens that the salvage work is housed in a building that in its day was the biggest power generating station on the Detroit system, Delray No. 2. Now, in the space where once were the largest boilers in the world, men are busy restoring to usefulness the very metal through which coursed the energy released in those boilers. In the turbine room, where once stood in impressive array a long rank of vertical turbogenerators, now are stored the survivors of another day, station transformers, motors, generators, turbines, oil circuit breakers, switches, all the many types and kinds of apparatus that time has recalled from the front line.

Thus at Delray No. 2 of yesterday may be seen salvage in three aspects, the saving of men, of things and of a building, the realization of the value and the usefulness that remain in all three.

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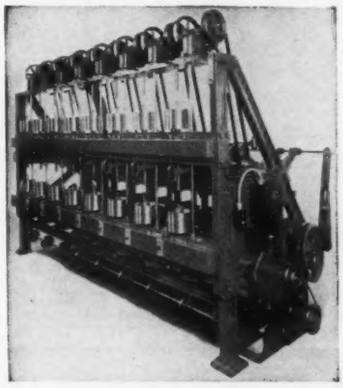

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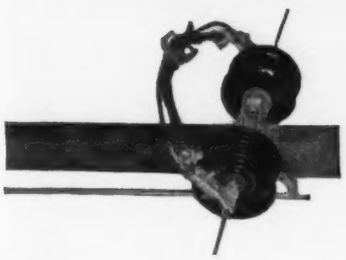

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Sangamo Electric Holds Open House for Visitors

Sangamo Electric Co., in commemorating its 40th anniversary, recently held "Open House" at which relatives and friends of employees inspected the plant. More than 600 visitors were taken through during the afternoon, and more than 4,000 during the evening hours. Employees with service records of 25 years or more acted as a committee of guides. At the request of the employees, working hours for the day were arranged from noon until 4 p.m., and from 5:30 to 9:30 p.m.

A souvenir booklet describing the company and a set of plastic coasters bearing the 40th anniversary seal and trademark of the company were presented to each visitor. Signs marked each department and the more intricate machines were explained with signs and lectures.

•

Electric Truck Shipments

Domestic shipments of electric trucks and tractors, as reported by ten manufacturers representing the entire industry, totaled 47 for January, as against 62 for December and 89 for January a year ago, according to the Department of Commerce.

•

Lead Shipments Show Loss

Domestic shipments of lead to manufacturers for cable covering during 1938 totaled 51,571 short tons as compared with 85,597 in 1937, according to the American Bureau of Metal Statistics.

•

Starts Refrigeration Drive

To stress the fact that danger lines in food preservation are below 32 degrees and above 50 degrees, the Georgia Power Co. is using the slogan "Thirty-Two Fifty or Spoil" in its spring refrigerator campaign, which began last week and runs through April 28.

•

Closes Wiring Contracts

EHFA has announced that contracts have been closed with the city of Sheffield, Ala.; Peoples' Co-operative Power Association of Olmsted County, Rochester, Minn.; Grant County Co-operative Rural Electric Association, Lancaster, Wis., and Minnesota Valley Co-operative Light & Power Association, Granite Falls, Minn. The contracts provide that EHFA and the contracting parties will co-operate in financing the wiring or re-wiring of existing homes and farms located on the power lines.

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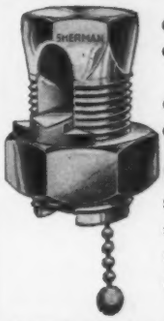
QUICK
CONNECTIONS



- **tough bronze**
- **full thread engagement**
- **no sharp edges**
- **large or small head**

For primary, secondary service, and transformer solderless line taps. Bolt, spacer, and nut an integral assembly. Strong.

SOLDERLESS SERVICE CONNECTORS

SC-6X SC-6

Assembly

WEDGE-GRIP CONNECTORS

• For service entrance and all small wire connections. New, Economical, Simple construction. No lost screws—no connectors thrown away—no lost time. Two types of screw of tough bronze with copper body. Can be furnished in wide range of sizes to accommodate different wire capacities—#12 stranded to #4 stranded.

Get samples and Trade Bulletin No. 22.

H. B. SHERMAN MFG. CO.
BATTLE CREEK, MICH.

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Positions Wanted (full or part-time salaried employment only), ½ the above rates, payable in advance.

(See ¶ on Box Numbers)

Proposals, 40 cents a line an insertion.

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Box Numbers in care of any of our New York, Chicago, or San Francisco offices count 10 words additional in undisplayed ads.

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DISPLAYED—RATE PER INCH:

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns — 30 inches — to a page. E.W.

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SALARIED POSITIONS. $2,500 to $25,000. This thoroughly, organized advertising service of 29 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVES AND TECHNICAL MEN. Contact employers for positions through our confidential and effective methods. We negotiate preliminary overtures. Established 24 years. Inquiries invited. H. H. Harrison, Director, The National Business Bourse, 20 West Jackson Blvd., Chicago.

POSITIONS WANTED

(See also "Selling Opportunity Wanted")

ENGINEER SUPERINTENDENT 16 years experience, design, construction, operation, Diesel, Hydro, steam plants and systems. Familiar public relations, industrial problems seeks new connections Superintendent Municipal System. PW-574, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER. College graduate. Professional license. 8 years experience in Distribution maintenance and design, transmission lines, substations, and hydro-stations. Want opportunity with chance for advancement. Will go anywhere. Available immediately. PW-598, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL ENGINEER, 30, 7 years with internationally known communication corp., Inventive development operation, patent experience. Specialising in complicated circuits of all kinds. PW-605, Electrical World, 330 W. 42nd St., New York, N. Y.

MANAGEMENT EXPERIENCE OFFERED. Fifteen years background in district—division—and general management administration of gas and electric utilities—earlier actual experience in operating departments—with knowledge of policies and practices influencing public attitude, employee cooperation, energetic sales activity and operating efficiency. Employed at the present time but desire broader responsibilities. Graduate engineer. Married. PW-606, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY OFFERED

WANTED: Sales Engineer by manufacturer of Telemetering Equipment. Excellent opportunities for promotion. Outstanding personality, electrical engineering education, proven sales ability and highest character references required. Special consideration will be given to candidates who have had significant specialized engineering experience with electrical circuits including carrier-current channel projects. Write stating age, education, experience and salary desired. SW-604 Electrical World, 330 W. 42nd St., New York, N. Y.

OPPORTUNITY WANTED

IMPRESSIVE SALES RECORD and unusual qualifications including broad sales and advertising experience in promoting engineering equipment direct to user and through trade outlets. Following in electrical, heating, building and automotive fields. Good general utility assistant to busy sales executive in office or territory. Moderate starting salary. Immediately available. Southern New England or Metropolitan New York area preferred. SA-607, Electrical World, 330 W. 42nd St., New York.

Attention

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A manufacturers' representative in Detroit, covering Michigan and Toledo, Ohio, with contacts of long standing among central stations, steel mills, architects and engineers and industrial plants, is interested in getting in touch with a high grade manufacturer seeking sales outlet in this territory.

Here's a chance for some manufacturer to use our office as a branch in this territory.

RA-603, Electrical World,
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Dept. W-220 Church St.—New York City
National Sales Agents for
CLIFTON CONDUIT - RATTAN FITTINGS
RITTENHOUSE CHIMES

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in the form in which you want and can use them. For quick, dependable answers to hundreds of questions, in all phases of electrical engineering, see the

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Truly the standard in the field for 30 years. 28 big sections, each written by one of more outstanding authorities. 2816 pages of principles, applications, descriptions, methods, formulas, tables, diagrams, practical facts of every sort. Covers everything from units and conversion factors to electrochemistry, from industrial motor applications to electric wave filters. Price $7.00. Read it on approval.

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